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CHARLOTTE A. AIKENS

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PRIMARY

STUDIES FOR NURSES

A TEXT-BOOK FOR FIRST YEAR PUPIL NURSES

CONTAINING

COURSES OF STUDIES IN ANATOMY, PHYSIOLOGY, CHEMISTRY, HYGIENE, BACTERIOLOGY, THERAPEUTICS AND MATERIA MEDICA, DIETETICS, AND INVALID COOKERY

BY

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PREFACE TO FIFTH EDITION

THE first edition of this text-book contained the following explanatory statement which also applies to the present edition:

"The purpose of this book can be briefly stated. It is designed to assist in securing graded instruction in training-schools for nurses; to promote uniformity in the teaching of the subjects allied to nursing which the nurse needs as the groundwork for a nursing education; to assist in eliminating non-essential instruction of a medical character from the nursing course, and to save time and labor for both pupils and teachers. It brings together, in concise form, well-rounded courses of lessons in anatomy, physiology, hygiene, bacteriology, therapeutics and materia medica, dietetics and invalid cookery—those subjects which, with practical nursing technic, should constitute the first stage in a nursing education. It is not a text-book of practical nursing; neither is it a book of reference. It aims to fill the gap between the two, and to simplify the work of the pupil nurse's first year."

The book has proved of special value in schools in which the class work in the first year largely depends upon the superintendent and head nurses.

In this fifth edition the book has been fully revised. In the section on Dietetics numerous additions have been made. Several new tables have been added.

New illustrations and some additional matter have been inserted in the section devoted to Anatomy and Physiology.

CHARLOTTE A. AIKENS.

DETROIT, MICHIGAN,
February, 1923.

PREFACE

In venturing to add yet another to the already numerous text-books for nurses, it may properly be asked, "By what authority do ye this thing?" The purpose of this book can be briefly stated. It is designed to assist in securing graded instruction in training-schools for nurses; to promote uniformity in the teaching of the subjects allied to nursing which the nurse needs as the groundwork for a nursing education; to assist in eliminating non-essential instruction of a medical character from the nursing course, and to save time and labor for both pupils and teachers. It brings together, in concise form, well-rounded courses of lessons in anatomy, physiology, hygiene, bacteriology, therapeutics and materia medica, dietetics and invalid cookery—those subjects which, with practical nursing technic, should constitute the first stage in a nursing education. It is not a text-book of practical nursing; neither is it a book of reference. It aims to fill the gap between the two, and to simplify the work of the pupil nurse's first year.

Since the publication of "Hospital Training-school Methods and the Head Nurse," a large number of letters have been received from nurse superintendents in different parts of the country, asking how they might more nearly bring their training-school methods into conformity with the practical standards outlined in that book. While each letter related to some supposedly peculiar difficulty, in the final analysis most of them hinged on the question of text-books. Not that there were not many very ex-

cellent text-books available, but that each being devoted to a special subject contained hundreds of pages, presumably to be studied, and the time was not to be had in which to cover the ground laid out in each of these numerous text-books. A great many of the schools admitted to having made no attempt to teach from text-books anything but the theory and practice of nursing. Some required the pupil to own a treatise on materia medica, but used it mainly as a book of reference, the lecturer selecting from its pages here and there the subject matter of his lecture. On account of this "too-muchness" of most existing text-books, the old haphazard way of acquiring instruction by note-taking while a doctor lectured was still adhered to, though voted by all as most unsatisfactory.

In attempting to reply to these correspondents and advise as to text-books which pupil nurses should be required to own and study, it was found that under present conditions if teaching from text-books was adhered to, the least number of books to be covered to give a well-rounded course was ten, and that having bought and studied those ten, there were still left a considerable number of subjects to be provided for by lecture. On some subjects we could make choice of upward of a dozen books; on others we might search in vain for one. These ten text-books would probably average 350 to 400 pages each, and most of them contained a great deal of matter that was in no way likely to ever contribute to nursing efficiency. In anatomy and physiology, materia medica, and obstetrics this was particularly true. As books for occasional reference and general information on medical subjects they were admitted to be valuable by all the superintendents consulted on the subject, but as text-books, the contents of which were to be studied and digested by pupil nurses, they were voted as hopelessly discouraging. In many instances it was stated that nurses failed to grasp important practical points because of a too diffuse presentation of the subject.

The result of numerous conferences and much correspondence with superintendents of hospitals and training schools of wide experience and with physicians who have lectured in hospitals for many years is the present volume. It will be followed by another of similar size dealing with the studies for senior nurses. In these text-books the attempt has been made to boil down material that has hitherto been scattered through ten or more books, and arrange in a form so that it can be quickly and easily grasped the parts of the subjects with which pupil nurses might profitably become familiar. It is not claimed that the books contain all that a nurse need ever know. In the years following graduation she will have ample time to go more deeply into all the subjects if she so desires. It is quite probable that even this book may seem too elaborate to some teachers. Others will think it too much condensed, but the aim throughout has been to strike a "happy medium" between the extremes that exist in methods. "Simplify," "simplify," has been the burden of the appeals that have come from those who are interested in the preparation of these studies. At least a serious attempt has been made to separate from the nursing course a great deal that has found its way into lectures, and added materially to the burdens of pupil nurses.

The task has been undertaken because of a sincere conviction, born out of years of personal experience with training-school problems, that such a book was needed, and because of the repeated urging of personal friends in the hospital world. Advice and help have been freely sought regarding every step of its preparation, from physicians, nurses, and superintendents who are in active hospital work, and the author feels under deep obligation to a wide circle of friends for much kindness received in numerous ways connected with the undertaking. Of necessity, in preparing a text-book of this kind, there has been some overlapping of the ground covered in some of the text-books devoted to practical nursing. This, as

will be readily recognized, has been unavoidable, since most of the text-books touch, lightly or otherwise, on all the subjects treated in this volume.

Especial thanks are due to Miss Emma A. Anderson, Superintendent of New England Baptist Hospital, Boston, and to Miss Carrie P. Vanderwater, Principal of Grace Hospital Training-school for Nurses, Detroit, for valuable practical suggestions; to Miss Emma J. Lynch, formerly Matron of Iowa Methodist Hospital, Des Moines, for much assistance in arranging the lessons on invalid cookery; to Dr. Theodore McClure, Superintendent and Surgeon of Solvay Hospital, Detroit, to Dr. W. L. Babcock, Superintendent of Grace Hospital, Detroit, and to Dr. W. R. Chittick, of Detroit, for critical reading of portions of the manuscript; to Dr. R. M. Phelps, Assistant Superintendent of State Hospital for the Insane, Rochester, Minnesota, and to Dr. Geo. S. C. Badger, of Boston, for much helpful advice as to what should be included and excluded; and to a large number of superintendents of hospitals and training-schools who through their letters helped to furnish the incentive for the undertaking. We are also under obligation to the Good Health Publishing Company for permission to use some of the cuts of the invalid trays; to the W. B. Saunders Company for kindly furnishing many of the cuts for illustration, and to Dr. F. A. Washburn, Superintendent of Massachusetts General Hospital, Boston, for the photograph and diagrams of the sterilizing hopper. Believing that many lessons may be more quickly grasped by means of the eye than in any other way, a special effort has been made to secure suitable illustrations which might be helpful in teaching.

It will be seen that much has been borrowed in direct quotation from medical writers, to whom, as far as possible, credit has been given and thanks are now accorded. Of necessity, a book of this kind must be largely compiled from medical works. If mention has not been made of all the individual sources from which encouragement

and help have been obtained, it is not because such assistance is not remembered with sincere appreciation.

The following is a list of books which have been used as reference and from which information has been gleaned.

Anatomy, Gray; Human Physiology, Furneaux; Physiology, Brubaker; Principles of Bacteriology, Abbott; Disinfection and Disinfectants, Rosenau; Hygiene and Public Health, Parkes; Personal Hygiene, Pyle; Materia Medica and Therapeutics, Bartholow; Materia Medica, Pharmacy, and Therapeutics, Potter; Practical Dietetics, Thompson; Food in Health and Disease, Yeo. Information has also been freely gleaned from government bulletins.

CHARLOTTE A. AIKENS.

DETROIT.

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PRIMARY STUDIES FOR NURSES

INTRODUCTION. SUGGESTIONS TO TEACHERS

In arranging this text-book for first-year pupil nurses, it seems fitting to devote the opening chapter to an explanation of the general plan on which the book is based.

In the beginning it has been taken for granted that the school year consists of not less than thirty-eight weeks. In many schools it extends to forty or more weeks. It is generally admitted that the first year should be devoted to certain foundation studies, leaving the theory of the management of diseases and special nursing practise for a later period. The groundwork studies in a nursing education are general nursing technic, anatomy, physiology, hygiene, bacteriology, materia medica, and dietetics. To this has been added in later years some instruction in elementary chemistry. The study of ethics is so intimately interwoven with every phase of a nurse's work, her behavior, her life, that a definite place should be given to it in the schedule of every period of the training course.

Nursing, so far as the science of it is concerned, is a combination of many other sciences. The nurse needs to have an elementary knowledge of anatomy and physiology if she is to intelligently care for the human body, but she has no use for a great deal that is taught on those subjects to medical practitioners. She must have some knowledge of the properties and action of the

common drugs, since she is constantly handling and administering them, but a comparatively short course in materia medica should be sufficient to teach her the facts about drugs which it is essential for her to know. She must understand dietetics and cookery to a certain extent, but has no need for an extended or elaborate course in domestic science or the chemistry of foods. She needs a general understanding of the principles of hygiene and household sanitation, but the ordinary nurse need not go very deeply into hospital architecture or sanitary science in order to be able to efficiently practise the art of nursing. While at first glance the nurse's field of study may seem very circumscribed, it is not so in reality. The real essence of nursing must always be personal service to the sick or helpless. The nurse is at liberty to draw, to a certain extent, from many sciences, and to use for the relief of suffering the discoveries made in other fields of science, but she cannot go far into any of these sciences as a nurse before she becomes a trespasser on other provinces. Into whatever field she may go gleaning for knowledge she is certain to be soon recalled, to have the truth again emphasized that her chief work must not be along intellectual lines, that advancement in nursing must come by improved methods of practical service.

How much to teach and how to give due proportion of time to each of the studies deemed necessary in the first year or junior period has been one of the greatest problems which teachers of nurses have had to wrestle with. However much value we may put on any of these subjects, we must admit that the actual doing of nursing duties counts for by far the most in promoting nursing efficiency. Granting that, the next question that arises is, Which of the foundation studies should come first and which last? It is obvious that however valuable or necessary the information may be to a nurse, the subjects cannot all come first. The desirability of having all of these subjects studied before entering on practical nursing

duties has been and is still strongly advocated. The plan has some advantages and some disadvantages. In the great majority of schools the theoretic studies must be pursued while the pupil is doing actual nursing.

The order of sequence and the proportion of time that may be allotted to each of the subjects treated in this book are matters to which much study and discussion have been given. Nothing is surer than that if the course on anatomy and physiology is spread out unduly, and a lesson is planned to be given every week throughout the pupil nurse's first school year, as is advocated in some text-books and practised in some schools, nothing is surer than that subjects of equal or greater importance are crowded out, or the practical care of the sick is not thoroughly taught and practised.

In arranging these studies three points have been especially aimed at: conciseness, adaptability to the practical needs of the nurse, and the avoidance of uncommon technical terms as far as possible. Almost every paragraph will admit of amplification by the teacher, while at the same time the effort has been made to include the points most important. The plan has been generally followed of presenting the broad outlines of a subject first before taking up minute details. When one considers the number of new ideas which the minds of first-year pupils are required to grasp even in doing ordinary practical duties, the necessity of condensing the theoretic work must be kept in mind if a student is expected to do efficient, thorough work.

To know the fundamentals of a subject well is better than to superficially cover an elaborate and minute presentation of it, or to cram numerous pages before examination and quickly forget.

The knowledge of anatomy which a nurse can really use or apply in nursing practice can be compassed within comparatively small limits.

In the studies in materia medica no attempt has been made to describe the appearance of drugs, and this

omission has already been commented on by friendly critics. It has been the author's conviction that to attempt to burden a nurse with the study of the theoretic difference in appearance between all the drugs mentioned in one lesson was unwise. It is suggested that specimens of each drug to be discussed in the lesson be taken to the class-room and shown to the pupils, and the important points and differences emphasized. It has also seemed unwise to require the pupils to memorize the different doses of a great many drugs; therefore only the doses of the most strongly acting drugs in common use have been given. It is expected that some book of reference on materia medica is provided by the hospital which the pupils can consult if they desire to know more of the drugs included in these studies or to go more deeply into the subject. Every nurse, before she goes out as an independent worker, should provide herself with a few books of reference, and especially one on materia medica.

If the number of drugs included seems too few, it is easy to make additions. It is estimated that over two hundred new drugs are placed on the market each year. Since it is manifestly impossible for a nurse to study all of them, it has not been thought wise to burden her with a great number in any one lesson.

For the nurse's own safety as well as the safety of the patients, before a pupil is admitted to the ward as a nurse, a simple practical talk on germs—where they are found, how they are transmitted, etc.—should be given, as it is obvious that practical methods of prevention will need to be used before the theory of bacteriology can be taught. It is also quite plain that the patients will have to be fed before the lessons on dietetics are studied. There is no order of arrangement of studies which can be made which will not be open to some such objection. Experience has shown that these difficulties are not so serious in actual practise as they appear to be on paper. If the nurse is taught the correct methods of doing actual

nursing duties, and carefully supervised as she ought to be for the first year at least, many of these theoretic difficulties lose their importance. At the same time, if a two or three months' preparatory course is planned for before the pupil is admitted as a nurse, or is allowed to assume responsibility for the actual care of the sick, if regular daily classes are planned for throughout those first three months, the nurse acting as assistant only, in the wards and departments for from four to six hours each day, experience has proved that many advantages accrue both to the hospital and the pupil.

The practical duties which nurses should be taught each year and the order in which they should be allowed to get the varied kinds of nursing experience they need has been treated in some text-books, and in some schools a well-defined plan is carried out relating to these matters, the pupil gradually being promoted by change to different wards. In the majority of hospitals, however, a careful classification and separation of patients according to their diseases is impossible, and the order of instruction in practical methods is largely determined, after the first few months, by the circumstances which arise and the general ability of the nurse.

In trying to arrive at a decision regarding the essentials which every nurse who calls herself a graduate should be taught, the following list of practical duties and general essentials has been arranged. It has been submitted to experienced nurse superintendents and hospital workers and approved, and is here presented as a contribution toward the solution of the highly important practical question, How much is a hospital responsible for teaching? Subsequent editions will doubtless call for additions or changes in this list, but it is the author's conviction that if a nurse has been taught correct methods of doing the practical duties here outlined, and has been given a reasonable amount of theory, she is certainly deserving of all the rights and privileges accorded to hospital graduate nurses:

1. How to sweep and dust a ward; when a damp duster should or should not be used; arrange ventilators and heaters; adjust shades and bedside tables; the care of stoves, dish-towels, cupboards, and refrigerators.

2. How to make a bed with or without a patient; adjust back-rests and pillows; change the bed with a helpless patient; disinfect beds, mattresses, and bedding.

3. How to prevent bed-sores; lift and move a helpless patient; care for the hair; how to manage bed-pans and urinals; to fill and apply hot-water bottles or artificial heat of any kind, and the precautions to prevent burning.

4. How to give a bath to a patient in bed; how to care for the mouth and teeth; how to change a gown with a helpless patient.

5. How to use a clinical thermometer, count the pulse and respiration, mark a clinical chart, and keep a daily record.

6. How to keep a bath-room in sanitary condition; disinfect urinals, sputum cups, bed-pans, rubber sheets, pus basins, and bath-tubs.

7. How to administer medicine by mouth; to read and understand the abbreviations and symbols in common use in a hospital; the precaution to be used in handling all drugs; the special precaution in giving opiates and sedatives; the best way to give oils, powders, stimulants, and purgatives.

8. How to give medicine by hypodermic injections; by rectum; by injection; by inhalation; by simply applying to the skin; how to apply ointments, and the points to be remembered and guarded against in the use of each.

9. How to prepare and give a simple enema; how to pass the colon-tube; the precaution to be used in giving stimulant, sedative, and nutrient enemata; how to relieve an overloaded and impacted rectum; how to give a colonic irrigation; how to care for each utensil before and after use.

10. How to save specimens of urine and other excreta for examination; how to pass the female catheter; how

to test the specific gravity and reaction of urine; the simple tests for albumen and sugar; how to ascertain the quantity passed in a given time; the points to be observed and noted regarding urine in special cases; how to give a vaginal douche.

11. How to receive new patients; list and care for their clothing and effects; care for hospital linen, blankets, and rubber goods.

12. How to arrange a patient for an abdominal examination; the nurse's duties regarding general examinations of the whole body; how to arrange for examination of the chest with patients in and out of bed; how to assist during an examination of the spine, rectum, and genital organs.

13. How to sponge to reduce fever; fill and apply ice-caps and coils; give injections of ice-water; apply hot and cold packs; the use of the bath thermometer; how to restrain delirious patients; general and specific precautions to be observed to prevent infection; the special method of reducing fever preferred by the hospital physicians.

14. How to prepare and apply hot fomentations; ice compresses; poultices; sinapisms; antiseptic compresses; blistering agents; the care of blisters; arrange for moist air and medicated steam; improvise a croup tent with provision for steam inhalations; manage the use of gargles, sprays, and other applications to the throat.

15. How to prepare and apply roller bandages to head, arms, breast, feet, legs, abdomen, and hip; perineal bandages; many-tailed bandages; how to support an injured arm or leg.

16. How to dress and assist a weak convalescent patient; to prepare and serve fluid food to invalids; the points to be observed in feeding milk; methods of predigestion; the classes of diets and amount to serve; the diets suitable for special diseases and conditions; special precautions needed during convalescence; how to weigh infants and adults.

17. How to syringe ears and cleanse eyes; how to

manage eye compresses and drops; how to evert eyelids and make local applications; how to manage a nasal douche.

18. How to disinfect a room and its contents; arrange for sulphur and formaldehyd fumigation with ordinary appliances; how to manage infectious diseases in private homes.

19. How to assist the physician in aspirating and tapping; how to manage diaphoretic baths; dry cupping; lavage; enteroclysis; hypodermocylsis; spinal douches; Schott baths; medicated baths; Scotch douches.

20. How to properly care for the hands in the daily routine; hand disinfection; sterilize ward instruments and cleanse after use; prepare a patient for operation; arrange beds for operative patients; care for patients immediately following operations; special observations to be made regarding laparotomy patients; management of all classes of cases requiring drainage-tubes; best methods of lifting and handling surgical cases.

21. How to prepare plaster bandages; dressings for ward use; management of adhesive strapping; pad splints; manage extension apparatus; give first aid in fracture cases; undress accident cases; points to be recorded concerning accident patients.

22. The significance of symptoms and how to make and record observations; how to manage a condition of shock; check hemorrhage in emergencies; the measures to be used in giving first aid to cases of poisoning by opium, strychnin, and carbolic acid; to prepare and administer emetics; how to care for burns; how to administer oxygen.

23. How to calculate the amount of drug needed in preparing a given quantity of disinfectant solution; to make all the solutions in common use; the special precautions to be used in regard to each; how to prepare simple antiseptic mouth-washes from common materials; the effects on tissues of too strong solutions.

24. How to get ready for an operation in a hospital

without assistance; also in a private home; how to assist the surgeon in minor and major operations; the care of rubber gloves, ligatures, and sutures; the emergency remedies and applications that should be in readiness; the principles and methods of sterilization; the adjustment of patients to different positions on the operating-table; the after-care of the wound to prevent infection.

25. Simple measures that can be used for the relief of insomnia; general massage; when not to use massage; massage of special parts of the body; resistive movements and simple gymnastic exercises.

26. Management of common orthopedic cases; how to assist the orthopedic surgeon.

27. The arrangements necessary for outdoor treatment of pneumonia and tuberculosis; instruction to be given the family and patient, and general care of tuberculosis patients.

28. How to make and apply abdominal bandages; points to be guarded against; the making of tampons and vaginal applications; adjustment of pessaries; how to irrigate a bladder; use the vaginal speculum; remove and apply vaginal packing; disinfect the vagina for operations; the common positions used for vaginal examinations and treatments; how to prevent strain of the perineum and sphincter; management of intra-uterine douches; prevention of infection of perineum after operation; removal of stitches; uses and management of vaginal suppositories and applications; general management of gynecologic patients.

29. How to arrange an obstetric patient for examination; how to assist the physician during such examinations; the preparation of the patient for labor; the preparation of bed and rooms; the appliances desirable and those absolutely necessary for proper management during parturition; the nurse's duties during a normal labor when the physician is present and when he is not; the care of the patient immediately following delivery; measures to prevent hemorrhage; care of asphyxiated

infants; care of premature babies; first care of the new-born; management of the eyes and cord; general care needed during first two weeks; how to guard against infection of breasts; how to treat fissured nipples and manage inflamed breasts; the uses of ergot in lying-in patients; how to give and when and when not to give ergot; the use and care of the breast-pump; special care needed during puerperium; management of abdominal and breast binders; proper feeding of lying-in patients; advice to give prospective mothers; how to prepare artificial food for infants; simple measures for increasing or decreasing flow of milk.

30. What to do in a simple case of infantile diarrhea or "summer complaint" if no physician is available; preventive measures in relation to such diseases; the chief causes of constipation in children; preventive and relief measures; the management of a case of thrush; what to do in case of convulsions in children; in case of spasmodic croup while awaiting a doctor; management of whooping-cough, measles, and other common children's diseases.

31. The special points to be observed in the cookery of meats, eggs, toast, and special nourishment for invalids. Tray setting and attractive serving.

32. How to improvise hospital appliances out of common things in emergency; how to feed obstinate or insane patients; how to devise occupations and entertainment for children and adults during convalescence.

SUGGESTIONS FOR CLINICS AND DEMONSTRATIONS (FIRST YEAR)[1]

1. Beds, bedding, bed-making, with and without a patient, management of helpless patients, changing beds, bed-making for operative patients, use of rubber cushions, bed-rests, cradles, arrangement of pillows, etc., substitutes for hospital appliances.

2. Sweeping, dusting, preparing room for patient; disinfection of bedding, furniture, etc.; care of patient's clothing in ward and private rooms.

[1] As recommended by American Hospital Association.

3. Care of linen rooms; care of blankets, spreads, etc.; care of bath-rooms and appliances; disinfection of excreta and utensils.

4. Baths: Full; sponge, to reduce temperature; foot; vapor.

5. Administration of rectal injections for laxative, nutritive, stimulant, and astringent purposes; care of appliances.

6. Vaginal douches; methods of sterilizing appliances; use and care of catheters; vesical douches.

7. Hot and cold applications; making of poultices, fomentations, compresses; methods of application; care of hot-water bottles; uses and care of ice-caps and coils.

8. Chart keeping; methods of recording bedside observations.

9. Making of bandages: Roller, many tailed, plaster, abdominal, breast; making of pneumonia jackets.

10. Methods of applying roller bandages.

11. Methods of applying other bandages.

12. Appliances to prepare for ward examinations and dressings. Sterilization. Nurses' duties during ward dressings.

13. Preparation of patients for operation.

14. Preparation and care of surgical dressings, sponges, swabs, etc. Hand disinfection.

15. Tray setting and food serving; feeding of helpless or delirious patients. Management of liquid diets.

16. Administration of medicines: Methods of giving pills, tablets, capsules, powders, oils, plasters, liquids, ointments, etc. Use and care of medicine-droppers, minim glasses, graduate glasses, atomizers, inhalers, hypodermic syringes, etc. Management of inhalations, eye drops, suppositories, etc.

17. Care of the dead.

18. Symptomatology: The pulse; correct methods of examining the pulse; volume, tension, rate, rhythm. Effects of exercise, emotions, baths, drugs, shock, and hemorrhage.

19. General observation of the body. The face in disease. The skin. Expression of eyes, teeth, mouth, etc.

20. Respiration: Normal; respiratory affections. Pneumonia; change in respiration; cough, sputum. Crisis and lysis explained and charts shown.

21. Typhoid fever: General changes; face; rose spots; temperature charts. Changes in temperature and pulse explained. Danger signals. Methods of restraining delirious patients. Prophylactic measures.

22. Specimens of excreta; nurses' duties regarding them; importance, etc.

SUGGESTED BOOKS OF REFERENCE FOR FIRST YEAR STUDENTS [1]

"The Structure and Functions of the Body," Fiske.
"Human Physiology," Ritchie.
"Human Physiology," Furneaux.
"The Story of the Bacteria," Prudden.
"Elements of the Theory and Practice of Cookery," Williams and Fisher.
"Materia Medica and Therapeutics," Parker.
"Drugs and Solutions," Stimson.
"Materia Medica for Nurses," Blumgarten.
"Preventable Diseases," Woods Hutchinson.
"Elementary and Applied Chemistry," Irvin, Rivett, and Tatlock.
"A Text-book of Physics and Chemistry for Nurses," Bliss and Olive.
"The Principles of Human Nutrition," Jordan.

[1] The above-mentioned set of books bear directly on the lessons outlined in this volume. Are simple in style and language, and especially suited for first-year pupils.

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SECTION I

Anatomy and Physiology

CHAPTER I

GENERAL STRUCTURE OF THE HUMAN SYSTEM

Human anatomy is that branch of science which has for its object the investigation or study of the structure of the body.

Human physiology is that department of science which has for its object the study of the uses or functions of the different parts of the body in health.

The study of anatomy is usually carried on by using the dead body as subject matter. The science of physiology requires that it be studied on the living subject.

Body Surfaces.—In viewing the body as a whole, anatomists observe the rule of placing the body with its face toward the observer, erect, and with the palms of the hands turned forward.

The *ventral surface* is the name given to the front of the body, and the *dorsal* to the back.

The *median line* is the term used to indicate an imaginary line drawn from the top of the head through the middle of the body.

The human body has been compared to a house, of which the bones constitute the framework. This framework serves the double purpose of supporting and affording protection to the softer parts of the body.

An examination of the body will show that it is made up of a number of distinct structures, each of which has a definite duty or function to perform. The term "organ" is applied to these distinct structures, as, for instance, the

tongue is known as the organ of speech; the eye, as the organ of vision; the stomach, as an organ of digestion, etc.

An *organ*, therefore, may be defined as any part of the human body to which a definite work or function in the general activity of the body has been assigned.

A *common division of the body* is into head, trunk, and extremities. The *skull* or cranium is a large, hollow, bony structure composed of a number of smaller bones which enclose the brain.

Connecting with the cavity of the skull at its base is the spinal column, formed by the union of the bones of the spine.

The *spinal* or *vertebral column* is the central portion of the skeleton to which all the bones included in the trunk are related. Extending from the brain down through the spinal cavity or enclosure is the spinal cord, protected by membranes and by a fluid known as the cerebrospinal fluid.

Cavities.—The *body* has in it two great cavities—"a dorsal or back cavity and a ventral or front cavity. In these two cavities are found most of the organs of the body. The cavity in the skull and the canal in the backbone or spinal column, taken together, are the dorsal cavity. In this cavity lie the great centers of the nervous system, the brain and spinal cord." (Ritchie.)

The *trunk* is commonly divided into two main parts: the thorax or chest and the abdomen. In the upper division, or thorax, are contained the heart, lungs, and other smaller organs. In the abdomen are found the stomach, intestines, liver, pancreas, spleen, kidneys, and bladder.

These divisions are separated from each other by a muscular partition known as the diaphragm. The upper division is commonly spoken of as the thoracic cavity and the lower as the abdominal cavity. The ventral cavity includes the thoracic and abdominal cavities. Occasionally, for convenience of description, the lower part of the abdominal cavity is spoken of as the pelvic cavity.

A *summary of the main cavities of the body* might be made as follows:

1. The cranial cavity, the hollow within the skull which contains the brain.
2. The spinal canal, which contains the spinal cord.
3. The orbital cavity, which contains the eye.
4. The nasal cavity, which accommodates the structures which form the nose.
5. The buccal cavity or mouth contains the tongue, teeth, and salivary glands.
6. The thoracic cavity contains the heart, lungs, trachea or windpipe, esophagus or gullet, and the structures surrounding them.

The diaphragm is the dome-shaped partition between the thoracic and abdominal cavities.

7. The abdominal cavity contains the stomach, spleen, pancreas, liver, gall-bladder, kidneys in back portion, behind the peritoneum.
8. The pelvic cavity, which contains the bladder, rectum, and some of the reproductive organs.

The extremities are in two divisions: the upper extremities or the arms, and the lower extremities or the legs.

The bony framework of the body is covered externally by the skin. The cavities are lined internally with a membrane known as the mucous membrane. This mucous membrane lines all the cavities and organs which communicate with the outer world, such as the membrane found inside the mouth.

Muscles.—Stretched over the skeleton or framework of the body are the muscles which move it. The muscles form the greater part of the flesh which rounds out the body. They number more than five hundred and constitute almost half the body weight. The muscles have several different functions, which will be spoken of later.

Nerves.—In order that all parts of the body may work together there must be a ruling or controlling force. In the body this controlling force is the nervous system,

which governs all the organs of the body and causes them to work in harmony.

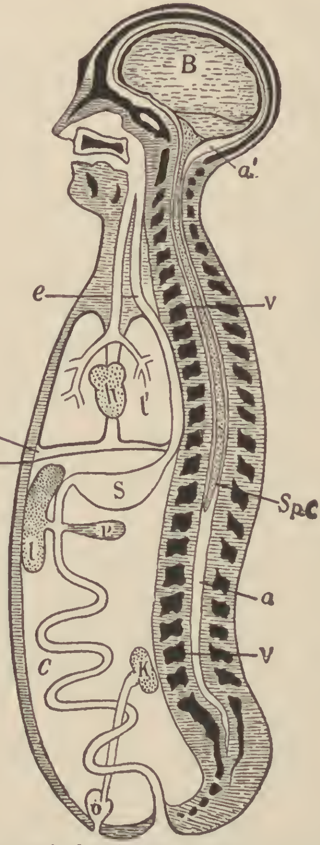


FIG. 1.—Diagrammatic longitudinal section of the body: *V*, *V*, Bodies of the vertebræ which divide the body into the dorsal and ventral cavities; *a*, *a'*, the dorsal cavity; *C*. *p'*, the abdominal and thoracic divisions of the ventral cavity, separated from each other by a transverse muscular partition, the diaphragm *d*; *B*, the brain; *Sp. c.*, spinal cord; *e*, the esophagus; *S*, stomach, from which continues the intestine to the opening at the posterior portion of the body; *l*, liver; *p*, pancreas; *k*, kidney; *o*, bladder; *l'*, lungs; *h*, heart (Brubaker).

Nutritive Fluids.—Circulating through the body and intimately concerned in the upbuilding of its parts are

the nutritive fluids of the body—the blood, the lymph, and the chyle. The blood has been termed "the vital fluid" because it is essential to life. It is carried through the body in tubes known as arteries, veins, and capillaries, and is kept in motion by the action of the heart.

Structural Elements.—Having viewed the body as a whole and noted its framework, its main divisions and parts, a closer investigation will show that the different organs or parts are composed of different materials commonly termed tissues, and that these tissues have certain distinguishing characteristics. The tissues are composed of minute parts called cells.

Life.—All life comes from a cell which has various properties, by means of which life is carried on—such as the power to appropriate nourishment from surrounding matter, the power to reject matter that is unsuitable, the power to grow and reproduce.

Life is defined as "a series of definite and successive changes which take place within an individual or plant without destroying its identity. Life is the continuous adjustment of internal to external relations. No life can come into being except as emanating from some preceding life. This applies to plant life as well as to animals and man. Each animal and plant produces its kind and that only. No individual life is identical in form, shape, and detail with the life from which it sprang, or with any other previous life. It has only 'general resemblance.' There are always individual differences."

A **cell** is the unit of life, the beginning of all life and growth, whether in plants or animals. A cell has been defined as a portion of transparent jelly-like material called *protoplasm*. It is surrounded by a thin wall and "resembles a small sac filled with clear, half-liquid substance. In each cell is a *nucleus* which is a denser portion of the protoplasm. Both the nucleus and the less dense material around it take in food and grow; both of them are alive. Taken together they are the protoplasm, the living substance of the cell." (Ritchie.)

These minute bodies of protoplasm, known as cells, appropriate nutriment from surrounding materials and reject materials for which they have no use. They may convert this food or nutriment into new tissues and store

FIG. 2.—Cell division. The nucleus of the cell divides and part goes to each end of the cell. A wall is formed across the cell, dividing it into two parts, each of which is a cell. All new cells are formed in this way. (From Ritchie's "Human Physiology," World Book Co., publishers.)

it up in the form of new cells, or may give it out in the various secretions and excretions of the body.

The cell has also the ability to divide into two cells, each cell having a nucleus, each being complete and hav-

FIG. 3.—Taste cells: *a*, Cover-cells; *b*, taste-cells proper.

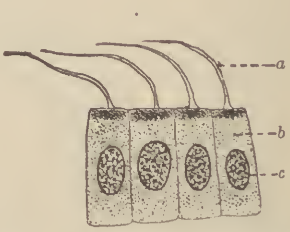


FIG. 4.—Cylindric ciliated cells: *a*, Cilia; *b*, cell-body; *c*, nucleus.

ing the same power as the parent cell. This process is known as reproduction.

The history of all forms of life may be summed up as follows: development, growth, reproduction, decay, and

death. All through life new cells are coming into existence and old cells are dying and being cast off.

FIG. 5.—Olfactory cells.

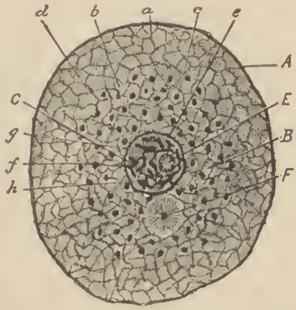


FIG. 6.—Diagram of a typical cell: *A*, Cell-wall; *B*, cell-body; *C*, nucleus; *E*, nucleolus; *F*, centrosome; *a*, spongioplasm; *b*, hyaloplasm; *c*, metaplasm or microsomes; *d*, exoplasm; *e*, nuclear membrane; *f*, nuclear network or chromatin filaments; *g*, nuclear matrix; *h*, nodal enlargements or net knots (Leroy).

From cells the various tissues of the body are formed. In all tissue there is a certain amount of lifeless matter besides the cells, known as the intercellular substance, which the cells have produced at different stages of growth.

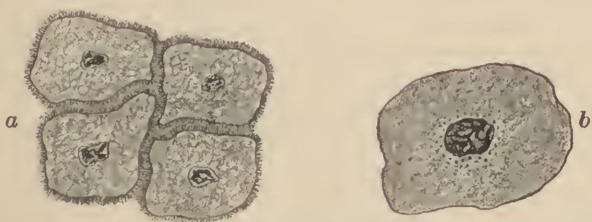


FIG. 7.—Epithelial cells from various localities: *a*, Prickle-cell from skin; *b*, goblet-cells (Leroy).

This intercellular substance acts as a form of cement and helps to hold the cells together.

THE SYSTEMS OF THE BODY

It has been found that the human body is made up of these minute elements or cells, which exist and multiply up to a certain point, independently of the cells which surround them. *Animal life* is the combined result of the lives of these cells which compose the living body. The organs of the body are made up of certain cells separated into groups which have each their special function to perform in maintaining life.

The united action of the cells from which the muscles are formed produce the movements of the body. The cells from which the liver is formed, when acting harmoniously, have for their special function the removal of certain impurities from the blood and the formation of certain fluids of the body. Other cells of a different type when collected form the brain and result in the production of thought and intelligence, and from others are formed the nerves which convey impressions to and fro between the brain and the external world. On the cells of the stomach we depend for the gastric digestion of our food. The cells of the lungs take in oxygen from the air. The red blood-corpuscles, or blood-cells, carry the oxygen through the body. Through these varied types of cells acting in harmony, each performing its peculiar function properly, the human system is maintained in a condition of health.

In studying the body it has been found convenient to arrange it in what are termed systems or groups of organs which work together for the performance of some special function or object. The *chief systems* are:

The osseous or bony system.
The muscular system.
The respiratory or breathing system.
The circulatory system.
The nervous system.
The digestive system.
The absorptive system.
The excretory or purifying system.
The reproductive system.

The Tissues.—In the construction of the various organs there are elementary parts or web-like structures known as tissues. These tissues may be divided into two main classes: those which maintain the activities of the body and those which are useful in supporting,

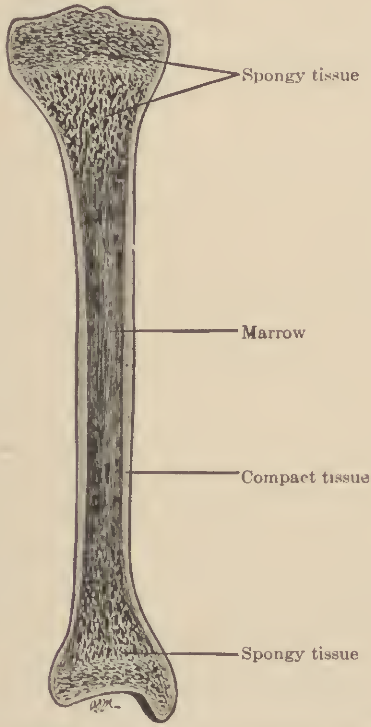


FIG. 8.—Longitudinal section of a long bone (Morrow).

holding together, and protecting the more important vital structures. In the first class would be placed muscular and nerve tissue; in the second would be placed connective tissue, adipose tissue, osseous tissue, cartilaginous tissue, epithelial tissue, and gland tissue.

Connective tissue (also called *fibrous tissue*) constitutes

a considerable portion of the body, binding together the several elements composing the different organs, and serving as a supporting framework for the various parts.

Osseous tissue forms the bony framework around which the soft tissues arrange themselves. It forms a large part of the substance of the teeth.

Muscular tissue is of two kinds, and is used to form the greater part of the soft structures of the body.

Cartilaginous tissue in adults is found chiefly at the ends of bones where a certain amount of elasticity is required.

Areolar or *cellular tissue* resembles fibrous tissue.

Nerve tissue is the most important of all the tissues of the body, as from it emanates thought, sensation, motion, and vital action.

Epithelial tissue is composed of cells united by a cement substance so arranged as to form the skin or covering for the body.

Adipose tissue is really a form of connective tissue in which the fat cells occupy the spaces between the fibers. It may be found in nearly all parts of the body in varying quantities, but it is most abundant just beneath the skin, where it serves as a protection from the cold.

Gland tissue is composed of cells which have the power to form some special substance out of the blood.

The **osseous** or **bony system** is composed of a large number of bones connected so as to form joints or articulations. It is bound together firmly at the joints by strong fibrous bands known as ligaments.

Cartilage or *gristle* is an elastic tissue, softer and more pliable than bone. It is used in certain parts of the body instead of bone where a yielding substance is required.

At birth an infant has no bones, strictly speaking, for bones begin as cartilage. The process of changing cartilage into bone is said to go on for the first twenty years of life at least, the original flexible cartilage becoming gradually stiffened by the deposit of bone-making elements among its cells.

The **muscular system** is composed of the flesh or muscle which surrounds the bones; and the muscles, in turn, are made up of fibers or collections of muscle cells. Through this system motion in the body is made possible. The muscles also contribute to the rounding out of various parts of the body.

The **respiratory** or **breathing system** consists of the lungs, the trachea or windpipe, and larynx, together with the diaphragm and chest walls. Its function in the body is to introduce oxygen into the blood and eliminate from the system certain injurious products.

The **circulatory system** is composed of the heart and blood-vessels, including arteries, veins, and capillaries. Its function is the distribution of blood to all parts of the body.

The **nervous system** has two main divisions: the cerebrospinal system and the sympathetic system.

The *cerebrospinal system* consists of the brain and its nerves and the spinal cord and its nerves.

The *sympathetic system*, which is also termed the ganglionic system, consists of double chains of ganglia or knots of nerve matter situated on either side of the vertebral column. The chief functions of the nervous system are to receive and transmit impressions, impulses, or messages to and from the outer world by means of the organs of the five senses. The skin is the organ of touch; the eye, of sight; the nose, of smell; the ear, of hearing, and the tongue, the organ of taste. Through its connection with the muscles, the nervous system controls the motions of the body. The nerves and muscles are sometimes classed together as the nervomuscular apparatus, or the apparatus whose function it is to produce motion.

The **digestive system** consists of the mouth, pharynx, esophagus, stomach and intestines, and the organs known as glands connected with them, which prepare the digestive materials. The function of this system is the complete digestion of the food needed for the body.

The **absorptive system** consists of capillary blood-vessels and other vessels, known as lymphatics. The chief function of this system is to convey the new material derived from food supplies into the blood, whereby it is distributed throughout the body to repair waste and make growth possible.

The **excretory** or **purifying system** has for its function the separation of impurities from the blood and the removal of waste matter from the body. The organs chiefly concerned in this work are the lungs, the skin, and the kidneys. To these are sometimes added the liver and bowels. The lungs, the skin, the urinary apparatus (which consists of the kidneys, the bladder, and the ureters or tubes which connect them), and the bowels are said to constitute the sewer system of the body.

The **reproductive system** has for its function the perpetuation of the race or species to which an individual belongs. The organs which constitute this system differ in the two sexes and need not be considered in a general description of the human structure.

The **blood** is a fluid tissue. It is the most important fluid of the body and is estimated to constitute about one-eighth of the body weight. The amount is said to be from 16 to 18 pounds in an individual of average size and general development.

Glands form an important part of the mechanism of the body.

A *gland* has been defined as " a collection of cells which can form a secretion or an excretion."

Excreting glands separate from a part substances which have no further part to play in the bodily functions.

Secreting glands form from the blood substances which did not exist in it before which the body needs.

Some of the glands perform both the secretory and excretory functions. Most of them are provided with ducts which convey the secretions or excretions to other parts.

Ductless glands are believed to manufacture substances that are absorbed by the body tissues. The spleen is the largest of the ductless glands.

Waste and Repair.—In health each particular organ has the power to use new material to repair itself, and the human machine may be said to work properly so long as this power of repair is maintained and sufficient new material is supplied.

The *human body* is frequently compared to an engine constructed for work, needing to be constantly supplied with material from which energy or force or power to work is produced. The human machine, however, differs in this respect from the artificial, in that whether it is at work or at rest the process of waste, wear, or disintegration goes on. Its machinery cannot stop while life lasts. Every thought, every act, or motion causes waste of some of the tissues. The material for the renewal of the different elements of the body that are constantly being lost must be supplied through foods. So long as the process of waste and repair are about equal, the balance of health is maintained.

World Materials.—The tangible materials of the world are made up of minerals, plants or vegetables, and animals. Minerals have neither life nor growth. Plants live, grow, and die, but have no power of voluntary motion and no intelligence. In the animal kingdom there is life, growth, motion, intelligence, and will.

Chemical Composition of the Body.—Of the seventy or more elementary substances known to chemists, about fifteen are found in the human body. The four chief elements are oxygen, carbon, hydrogen, and nitrogen. Besides these, calcium or lime, phosphorus, sulphur, potassium, iron, and a few other ingredients are found in small quantities. These are termed "elementary substances."

"An *elementary substance* or element is a substance which consists of only one kind of matter, and, therefore, cannot be divided into two or more simpler substances."

A *compound substance* is one which consists of two or more elements chemically combined, and which may be analyzed and split up into those elements.

The chemical elements of which the body is composed may be divided into two main classes: organic and inorganic. This same classification applies to the foods which maintain the body.

Organic substances are vegetable or animal substances which are prone to putrefaction.

Inorganic substances are minerals, of which the principal are water, common salt, potash, lime, and iron.

Life cannot be maintained on mineral substances alone nor on organic substances. Food substances must contain a mixture of these.

CHAPTER II

THE HUMAN SKELETON

The skeleton is the framework of the body. It has three chief functions:

1. To support the body.
2. To protect parts of the body that are easily injured.
3. To provide a system of levers by means of which movements of the body may be made.

The human skeleton is made up of 200 bones, which are arranged as follows: In the skull, 22; in the trunk, 52; in the upper extremities, 64; in the lower extremities, 62. In addition there are four bones in each ear called ossicles or "little bones." Some bones which are distinct in infancy become fused in the adult. These bones are the framework of the body, and also protect the organs which they enclose.[1]

The **spinal** or **vertebral column** is composed of a number of small bones jointed so as to form a long bony tube known as the spinal canal. This tube contains and protects that part of the nervous system called the spinal cord. The spinal column forms a kind

[1] For Table of Bones, see Appendix, page 525.

of axis with which the various parts of the skeleton are connected. The head rests on the first of the spinal vertebra, known as the atlas; the second vertebra is the axis. These two are so connected as to allow a considerable degree of movement to the head. The vertebræ

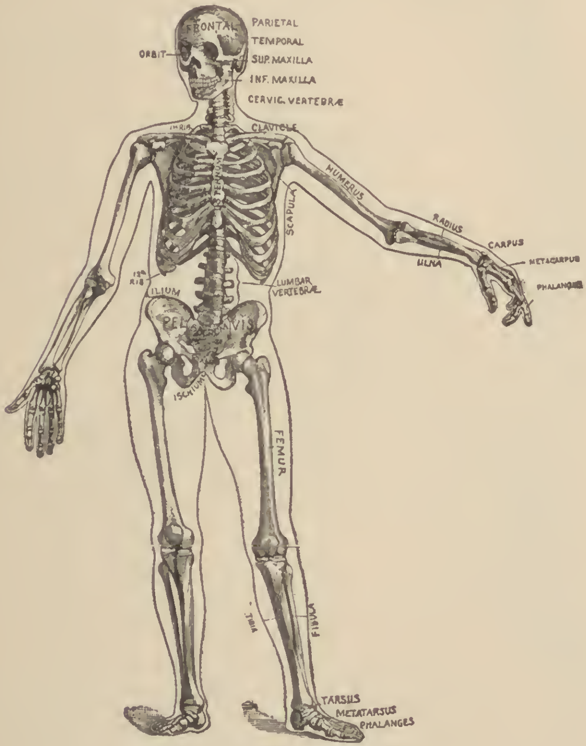


FIG. 9.—The skeleton (Lewis).

are united by pads of elastic cartilage. In early life there are thirty-three distinct bones in the vertebral column, some of which are finally fused, leaving, in adult life, twenty-six bones.

The bones of the trunk assist in forming a cavity which has three divisions—the thorax, abdomen, and pelvis.

Fig. 10.—The spinal column (Church and Peterson).

The **framework for the thorax** or chest is formed by the ribs (twelve pairs), which connect behind with the dorsal vertebræ. The first seven pairs are called the true ribs and the lower five false ribs. The upper seven pairs connect with the sternum or breast bone. The eighth, ninth, and tenth ribs are connected each to the one above by cartilage. The eleventh and twelfth are known as floating ribs. These connect with the spinal column, but do not connect with anything in front. The spaces between the ribs are known as intercostal spaces.

The **sternum** or **breast bone** is a flat narrow bone about six inches long located in the median line in the front of the chest. The first seven pairs of ribs, known as the true ribs, connect with the sternum by means of the costal cartilages.

The **clavicle** or **collar-bone** joins the upper part of the sternum or breast bone in front and the scapula or shoulder-blade in the back.

The **scapula** or **shoulder-blade** is a large, flat, triangular-shaped bone, located between the second and eighth rib on the back part of the thorax. It has a shallow cavity into which the head of the humerus, the bone of the upper arm,

fits. The glenoid cavity is the name given to this cavity, in which articulation with the humerus takes place. The joint formed at this point allows greater freedom of motion than any other joint in the body.

The **upper arm** has but one bone—the humerus.

The **lower part of the arm,** known as the forearm, has two bones—the radius and the ulna—the latter of which is the larger.

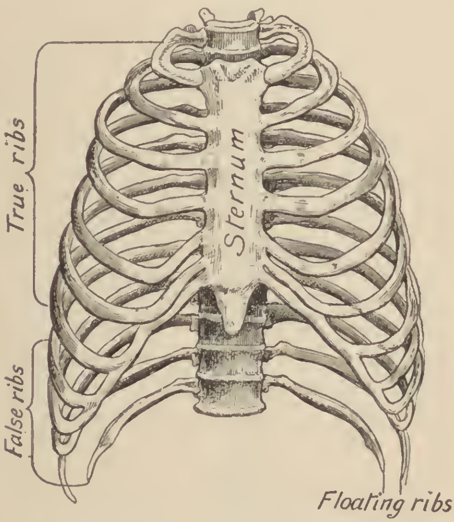


Fig. 11.—Thorax, anterior view (Ingals).

A perfect hinge-joint is formed with these bones and the humerus. The lower end of the ulna does not enter into the wrist-joint, but articulates with the radius.

The **wrist** is composed of eight small bones, known as the carpal bones. The wrist-joint is formed by the articulation of these small bones with the lower end of the radius and ulna.

The **hand** is composed of five metacarpal bones, which form the palm, and the fourteen phalanges. Three of the phalanges are in each finger and two in the thumb.

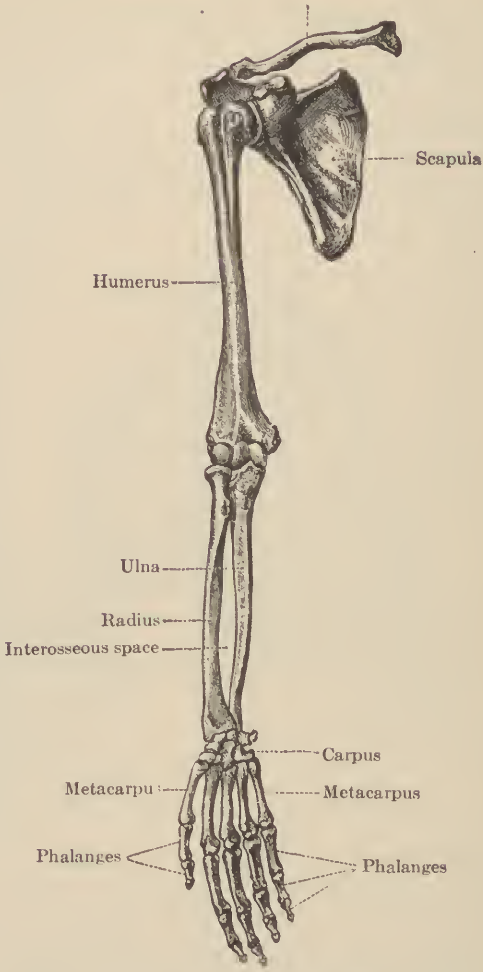


FIG. 12.—Bones of the upper extremity (Toldt).

The **pelvis** is composed of four bones, two ossa innominata, the sacrum, and coccyx. The ossa innominata,

commonly called the pelvic or hip-bones, are also called innominate bones, meaning a bone without a name. In infancy the os innominatum is made up of three bones, the ilium, which forms the wide flaring top of the pelvis; the ischium, and the pubis, the bone which forms the front of the pelvis. At the joint where these three bones meet, a deep cup-like cavity, called the acetabulum, is formed. The back of the pelvic wall is formed by the sacrum, upon the upper articulating surface of which the spinal column rests. The sacrum in infancy is five separate bones, which later are fused into one. The coccyx, which is the extreme lower point of the spinal column, is formed of four small bones. The junction of the pubic bone in front is called the symphysis pubis.

The pelvis is divided into two parts. The upper broad shallow part is known as the false pelvis, and the lower as the true. There are certain differences between the male and female pelvis. The female pelvis is wide at the pubic arches, lighter, shallower, and more roomy than that of the male.

The **lower extremities** are arranged somewhat similar to the upper. The femur or thigh bone has at its upper point a rounded head which fits into the acetabulum of the pelvis, forming a ball-and-socket joint. Two bony projections below the head of the femur are known as the trochanters.

The *tibia* or shin-bone and the *fibula* are the bones of the leg. The tibia is the larger and articulates with the femur, forming the knee-joint. The patella, or knee-cap, serves as a protection for the knee-joint. "The patella is more often broken by muscular violence than is any other bone in the body." (Treves.)

The *foot* is composed of the tarsal or ankle-bones, the metatarsal or instep-bones, and the fourteen phalanges of the toes, arranged like those of the hands. The foot is arched in form, powerful ligaments being fixed to prevent its falling flat. It is said that sixty-two bones are more or less necessary for the act of walking.

The **skull** is composed of the cranium, the large hollow bony case which surrounds the brain, and the face. There are eight bones in the cranium and fourteen in the face. Some of these bones are the result of two or more bones being fused, which in infancy were distinct. At birth, the bones of the cranium are not perfectly developed and not firmly jointed. Between them are spaces occupied by cartilage or membrane. These spaces are called

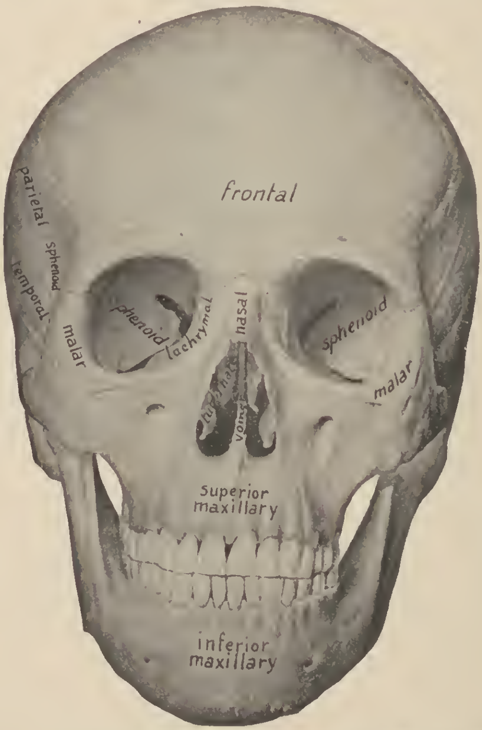


FIG. 13.—Front view of the skull (Sobotta and McMurrich).

the anterior and posterior fontanels. The posterior or occipital fontanel is a triangular soft spot on the top of the head which closes in a few months. The anterior

or frontal fontanel remains till near the end of the second year.

In the **composition of bone** mineral matter forms about two parts to one of animal matter. The chief mineral ingredient is lime, which produces hardness. Gelatin is the principal animal ingredient, and contributes to flexibility and elasticity. In children, the bones contain less mineral matter and are, therefore, softer, while in adults there is less animal matter, and, therefore, less elasticity.

Cartilage is the gristle or white elastic substance attached to certain bone surfaces. It is of several varieties, all of which serve as a flexible connecting material between bones. Cartilage is always found where strength combined with a certain degree of elasticity is required. It readily yields to extension or pressure, yet quickly resumes its original shape. The elasticity of the chest walls is a familiar example of the uses of cartilage. In the aged the bones are brittle, fracture easily, and heal slowly with great difficulty.

The term *green-stick fracture* is applied to the condition in which the bone of a child bends. Some of the outer fibers may break, but not the complete bone.

Rachitis or *rickets* is used to describe the condition very common among insufficiently nourished children in which there is a lack of mineral substance. The bones are flexible, bend easily, and often become permanently misshapen.

The Periosteum.—All bones are covered with a strong fibrous membrane known as periosteum, which supplies nutrition to the bone. If, by any means, the periosteum becomes injured, so that it can no longer nourish the bone, necrosis or death of bone results.

The joints or articulations of bones are surrounded by a smooth elastic cartilage. The cartilage is supplied with a membrane called the synovial membrane. This membrane secretes the synovia, a fluid which serves to lubricate the joints.

Bones in general are divided into four classes: long, as the femur or humerus; short, as the wrist bones; flat, as in the top of the skull; and irregular, as the vertebræ. There are certain surface markings of bone to which special names have been assigned:

A *process* is a prolongation or prominence of a part—a slender projecting point.

The *alveolar process* is that border of a jawbone which contains the tooth-sockets.

The *odontoid process* is a tooth-like point of the axis which ascends and unites with the atlas.

The *mastoid process* is the conic projection at the base of the mastoid portion of the temporal bone.

The *olecranon* is a curved process of the ulna at the elbow.

A *foramen* is an opening or hole through a bone.

A *spine* is a long or sharp projection.

A *fossa* is a depression or furrow.

A *tuberosity* is a bony protuberance.

A *crest* is a surmounting part or a prominent border.

A *sinus* is a recess, cavity, or hollow space. It is further defined as an air-cavity in one of the cranial bones.

Note.—For Table of Bones of Skeleton, see Appendix.

CHAPTER III

MUSCLES AND JOINTS

THE MUSCLES

THE skeleton supports the body. Over the framework of bones the muscles are stretched. *The muscles move the body.* This is their first and chief function. Muscles help to enclose the cavities of the body and protect the internal organs. Another function of muscles is to as-

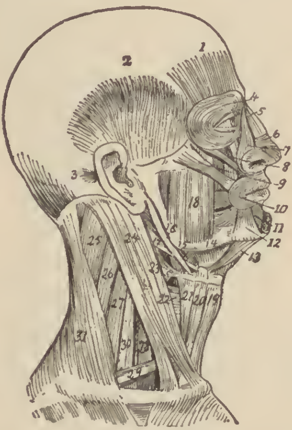


FIG. 14.—Muscles of the right side of the head and neck: 1, Frontalis; 2, superior auricular; 3, posterior auricular; 4, orbicularis palpebrarum; 5, pyramidalis nasi; 6, compressor naris; 7, levator labii superioris alæque nasi; 8, levator labii superioris; 9, zygomaticus major; 10, orbicularis oris; 11, depressor labii inferioris; 12, depressor anguli oris; 13, anterior belly of digastric; 14, mylohyoid; 15, hyoglossus; 16, stylohyoid; 17, posterior belly of digastric; 18, the masseter; 19, sternohyoid; 20, anterior belly of omohyoid; 21, thyrohyoid; 22, 23, lower and middle constrictors of pharynx; 24, sternomastoid; 25, 26, splenius; 27, levator scapulæ; 28, anterior scalenus; 29, posterior belly of omohyoid; 30, middle and posterior scalenus; 31, trapezius (Dorland's Dictionary).

sist the ligaments to bind the skeleton together at the joints. Most of the muscles stretch across a joint, and the large muscles add greatly to the strength of the joint.

The muscular tissue which covers the bone, and which is the immediate cause of motion in the various parts, derives its power from certain cells. Muscle cells are

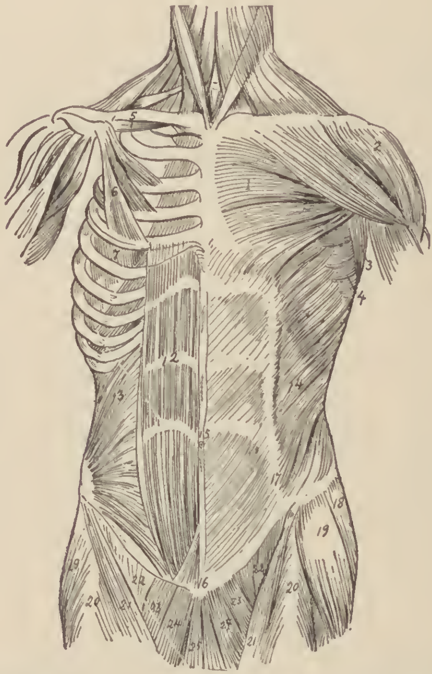


FIG. 15.—Muscles of the trunk from before (left side, superficial; right side, deep): 1, Pectoralis major; 2, deltoid; 3, portion of latissimus dorsi; 4, serratus magnus; 5, subclavius; 6, the pectoralis, sternocostal portion; 7, serratus magnus; 12, rectus abdominis; 13, internal oblique; 14, external oblique; 15, abdominal aponeurosis and tendinous intersections of rectus abdominis; 16, over symphysis pubis; 17, linea semilunaris; 18, gluteus medius; 19, tensor vaginæ femoris; 20, rectus femoris; 21, sartorius; 22, femoral part of iliopsoas; 23, pectineus; 24, abductor longus; 25, gracilis (Dorland's Dictionary).

longer than the average body cell, and are often spoken of as muscle-fibers. They have the power to contract, to draw together, and become shorter and thicker.

This causes the joint to bend over which the muscle passes.

There are two classes of muscles—voluntary and involuntary.

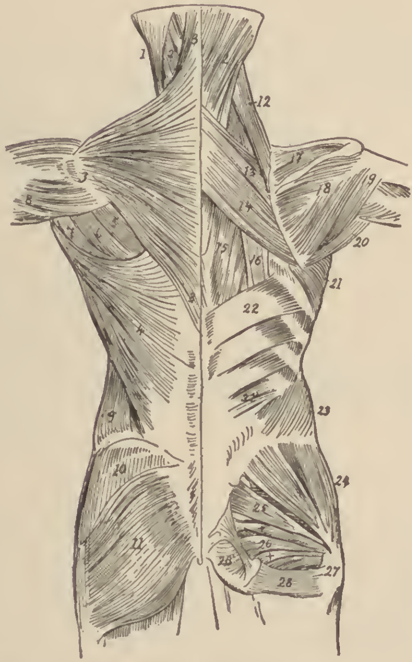


FIG. 16.—Muscles of the trunk from behind (left side, superficial; right side, deep): 1, Sternomastoid; 2, splenius; 3, trapezius; 4, latissimus dorsi; 5, infraspinatus; 6, teres minor; 7, teres major; 8, deltoid; 9, external oblique of abdomen; 10, gluteus medius; 11, gluteus maximus; 12, levator anguli scapulæ; 13, rhomboideus minor; 14, rhomboideus major; 15, part of longissimus dorsi; 16, tendons of insertion of iliocostalis; 17, supraspinatus; 18, infraspinatus; 19, teres minor; 20, teres major; 21, serratus magnus; 22, 22′, upper and lower part of serratus posticus inferior; 23, internal oblique; 24, gluteus medius; 25, pyriformis and superior and inferior gemelli; 26, 26′, portions of obturator internus; 27, tendon of obturator internus; 28, quadratus femoris (Dorland's Dictionary).

Voluntary muscles are under the control of the will. These are often termed *striped* or *striated muscles.*

Through these we have the power of voluntary motion and locomotion. Voluntary muscles form the greater part of the muscular system.

Involuntary muscles, or unstriped or non-striated mus-

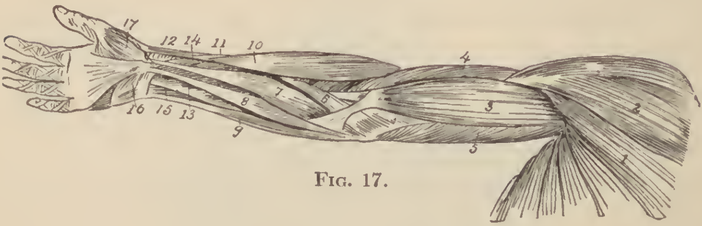


FIG. 17.

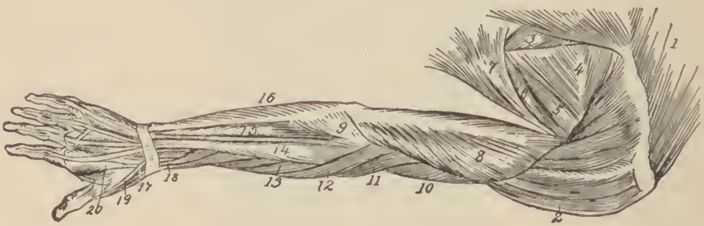


FIG. 18.

FIG. 17.—Superficial muscles of shoulder and arm (from before): 1, Pectoralis major; 2, deltoid; 3, biceps brachii; 4, brachialis anticus; 5, triceps; 6, pronator radii teres; 7, flexor carpi radialis; 8, palmaris longus; 9, flexor carpi ulnaris; 10, supinator longus; 11, extensor ossis metacarpi pollicis; 12, extensor brevis pollicis; 13, flexor sublimis digitorum; 14, flexor longus pollicis; 15, flexor profundus digitorum; 16, palmaris brevis; 17, abductor pollicis (Dorland's Dictionary).

FIG. 18.—Superficial muscles of shoulder and arm (from behind): 1, Trapezius; 2, deltoid; 3, rhomboideus major; 4, infraspinatus; 5, teres minor; 6, teres major; 7, latissimus dorsi; 8, triceps; 9, anconeus; 10, brachialis anticus; 11, supinator longus; 12, extensor carpi radialis longior; 13, extensor carpi radialis brevior; 14, extensor communis digitorum; 15, extensor carpi ulnaris; 16, flexor carpi ulnaris; 17, extensor ossis metacarpi pollicis; 18, extensor brevis pollicis; 19, tendon of extensor longus pollicis (Dorland's Dictionary).

cles, are found in the walls of blood-vessels, the heart, stomach, and internal organs.

Most of the voluntary muscles are connected with bones and are generally arranged in pairs, one muscle contracting to move the bone and its opposite bringing it back to its former position.

Flexors are muscles which bend the limbs.

Extensors are muscles which straighten the limbs.

Tendons are masses of white fibrous tissue which attach muscles to bone.

The terms *origin* and *insertion* are applied to the attachments of muscles to bone at opposite ends, but the origin of but a few muscles, comparatively, is absolutely fixed.

Hollow muscles are those which enclose cavities, and are usually involuntary. The heart and stomach are examples of this class.

Attachment of the muscles to the skeleton is accomplished in different ways, but chiefly by means of tendons. Muscles are also attached to cartilage, ligament, and skin. The muscle-fibers come together as they approach their tendinous extremity, and gradually blend with the fibers and cells of the tendons, which, in turn, insert their fibers into the bones.

Fascia is a fibrinous membrane covering muscles. An aponeurotic fascia is any fascia that serves to keep a muscle in its place and to connect muscles and tendons. The fascia not only envelops and binds down a muscle, but separates muscles into groups. Thus we find cervical fascia, pelvic fascia, thoracic fascia, etc.

Some Uses of Tendons.—Certain parts of the body need much greater strength than others, and to be able to make a great number of movements without being large and heavy, as, for example, the hands. In such parts of the body the muscles are placed at some distance and joined to the bones by tendons. The muscles that move the fingers are on the forearm and only slender tendons run to the hands.

The *abdominal muscles* when they contract compress the organs of the abdomen and narrow the cavity. In this motion they are assisted by the diaphragm. These muscles are able to exercise important influence in emptying the bowel and bladder, in the act of vomiting, and also during childbirth.

"These muscles connect the ribs and sternum with the rim of the pelvis, and prevent the upper part of the trunk from being drawn over backward by the long

Fig. 19.

Fig. 20.

Fig. 21.

Fig. 19.—Muscles of the inner side of thigh and interior of pelvis: 1, Iliacus; 2, psoas magnus; 3, obturator internus; 4, pyriformis; 5, erector spinæ; 6, gluteus maximus; 7, sartorius; 8, adductor longus; 9, gracilis; 10, adductor magnus; 11, semimembranosus; 12, semitendinosus; 13, rectus femoris; 14, vastus internus (Dorland's Dictionary).

Fig. 20.—Superficial muscles of the leg from inner side: 1, Vastus internus; 2, sartorius; 3, gracilis; 4, semitendinosus; 5, semimembranosus; 6, inner head of gastrocnemius; 7, soleus; 8, tendon of plantaris; 9, tendon of tibialis posticus; 10, flexor longus digitorum; 11, flexor longus hallucis; 12, tibialis anticus; 13, abductor hallucis (Dorland's Dictionary).

Fig. 21.—Superficial muscles of front of thigh: 1, Insertion of external oblique into iliac crest; 2, aponeurosis of external oblique; 3, external abdominal ring; 4, gluteus medius; 5, tensor vaginæ femoris; 6, sartorius; 7, iliopsoas; 8, pectineus; 9, adductor longus; 10, gracilis; 11, adductor magnus; 12, vastus externus; 13, rectus femoris; 14, vastus internus; 15, biceps flexor cruris (Dorland's Dictionary).

muscles of the back. The abdominal muscles also hold the internal organs in place, and by forcing back against

the dorsal wall of the abdominal cavity, support the spinal column in front of the lumbar region." (Ritchie.)

"The erect position of the human body is maintained by the combined influence of a large number of muscles

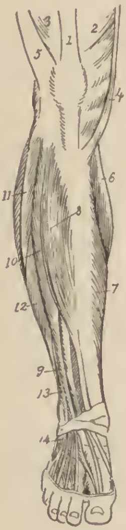


FIG. 22.

FIG. 23.

FIG. 22.—Muscles of leg and foot (from before): 1, Tendon of rectus femoris; 2, vastus internus; 3, vastus externus; 4, sartorius; 5, iliotibial band; 6, inner head of gastrocnemius; 7, inner part of soleus; 8, tibialis anticus; 9, extensor proprius hallucis; 10, extensor longus digitorum; 11, peroneus longus; 12, peroneus brevis; 13, peroneus tertius; 14, origin of extensor brevis digitorum (Dorland's Dictionary).

FIG. 23.—Superficial muscles of leg (from behind): 1, Vastus externus; 2, biceps flexor cruris; 3, semitendinosus; 4, semimembranosus; 5, gracilis; 6, sartorius; 7, 8, outer and inner head of gastrocnemius; 9, plantaris; 10, soleus; 11, peroneus longus; 12, peroneus brevis; 13, flexor longus digitorum; 14, tibialis posticus; 15, lower fibers of flexor longus hallucis (Dorland's Dictionary).

acting at the same time. The whole weight of the body rests on the arches of the feet, and the body may be supported in any position providing the center of gravity is situated vertically over any point in the space enclosed by the feet." (Furneaux.)

The **voluntary muscles** of the body number over three hundred. There are only a few of these which a nurse will ever have to distinguish in ordinary nursing practise.

FIG. 24.—Superficial muscles of hip and thigh (from behind): 1, Gluteus medius; 2, gluteus maximus; 3, vastus externus; 4, biceps flexor cruris; 5, semitendinosus; 6, semimembranosus; 7, gracilis; 8, sartorius; 9, adductor magnus; 10, 11, gastrocnemius; 12, origin of plantaris (Dorland's Dictionary).

The *occipital* and *frontal* muscles are the chief muscles of the head. They are usually spoken of as one muscle—the occipitofrontalis.

The *intercostal* muscles occupy the spaces between the ribs.

The *pectoral* muscles form the bulk of the muscular wall of the chest in front. They are known as the pectoralis major and the pectoralis minor.

The *diaphragm* is the large muscle separating the thorax from the abdomen. It is sometimes called the muscle of respiration. In shape it resembles a dome. It serves as the roof of the abdomen and the floor of the thorax. In it are three openings for the passage of the blood-vessels and the esophagus.

The *external oblique* muscle is the large muscle which covers the front of the abdomen. Other muscles of the abdomen are the internal oblique, transversalis, and rectus.

The *biceps* is a long muscle which helps to form the anterior surface of the arm.

The *triceps* is its opposite on the back of the arm.

The *deltoid* is a triangular muscle covering the shoulder-joint.

The *erector spinæ*, situated on each side of the spinal column, is attached by its continuations to all the vertebræ and assists in maintaining the erect position.

The *psoas muscles* are heavy muscles attached along the spinal column in the lumbar region. They brace the spinal column on the front of the lumbar curve, preventing too great a forward curvature at this point, and when they contract they lift the thigh.

The *gluteal* muscles form the fleshy masses of the buttocks.

The *posterior femoral* or *hamstring* muscles (three in number) cover the back of the thigh.

The *quadriceps* covers the front of the thigh. It is the principal anterior femoral muscle.

The *gastrocnemius* muscle forms the calf of the leg.

The *tendo Achillis* is the strongest tendon of the body. It connects the calf of the leg with the heel bone.

Abductors are muscles which draw away from the median line.

Adductors are muscles which draw toward the median line.

A *ligament* is a band of fibrous tissue binding bones together.

A *capsule* (in anatomy) is a membranous sac enclosing a part.

JOINTS OR ARTICULATIONS

The bones of the skeleton are connected by means of joints or articulations.

Joints are of two kinds:

Immovable or *fixed joints* are sometimes called sutures. An example of this class is the skull.

Movable joints are joints capable of motion. In movable and in some of the fixed joints the following structures enter into their formation: bone, cartilage, ligament, synovial sac, fluid, and capsule. Surrounding the joints of the extremities and some other joints are tendons, muscles, arteries, veins, lymphatics, nerves, fascia, and skin.

Movements in joints are gliding, angular, rotation, and

circumduction, the latter of which is a continuous circular movement of the limb.

Gliding joints are spoken of as gliding when the articulating surfaces are nearly flat, permitting a slight gliding movement, as in the ankle or wrist.

Ball-and-socket joints are freely movable. They consist of a rounded head which rotates in a hollow socket, as the hip-joints and shoulder-joints.

Hinge-joints permit of flexion and extension. The

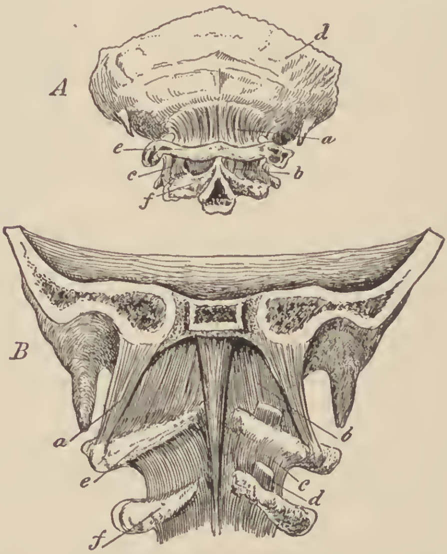


FIG. 25.—The craniovertebral ligaments: *A*, Posterior view: *a*, Posterior occipito-atlantal ligament; *b*, posterior atlanto-axial ligament; *c*, capsular ligament; *d*, posterior surface of occipital bone; *e*, posterior arch of atlas; *f*, lamina of axis. *B*, Anterior view: *a*, Lateral occipito-atlantal ligament; *b*, anterior occipito-atlantal ligament; *c*, anterior atlanto-axial ligament; *d*, capsular ligament; *e*, atlas; *f*, axis (Dorland's Dictionary).

elbow-joint is an illustration of this class; also the knee-joint, one of the most complicated joints in the body.

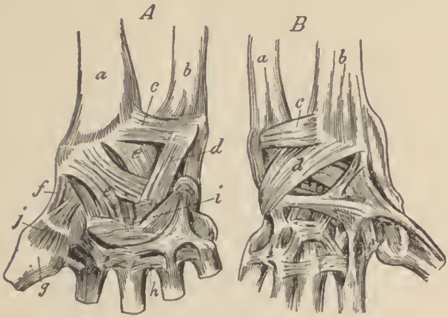


FIG. 26.—Ligaments of the wrist-joint: *A*, Anterior aspect: *a*, Radius; *b*, ulna; *c*, anterior radio-ulnar ligament; *d*, internal lateral ligament; *e*, anterior ligaments; *f*, external lateral ligaments, *g*, first metacarpal bone; *h*, palmar ligaments; *i*, palmar carpal ligaments; *j*, capsular ligament. *B*, Dorsal aspect: *a*, Ulna; *b*, radius; *c*, posterior radio-ulnar ligaments; *d*, posterior ligament (Dorland's Dictionary).

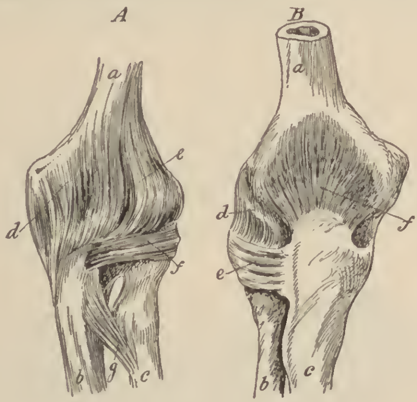


FIG. 27.—Ligaments of the elbow-joint: *A*, Anterior aspect: *a*, Humerus; *b*, ulna; *c*, radius; *d*, internal lateral ligament; *e*, anterior ligament; *f*, orbicular ligament; *g*, oblique ligament. *B*, Posterior aspect: *a*, Humerus; *b*, radius; *c*, ulna; *d*, external lateral ligament; *e*, orbicular ligament; *f*, posterior ligament (Dorland's Dictionary).

Pivot joints permit of rotation of one bone around another which remains stationary, as in the articulation

of the atlas and axis where the head joins the spinal column.

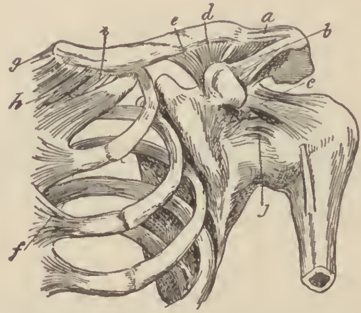


FIG. 28.—Ligaments of the shoulder: *a*, Superior acromioclavicular ligament; *b*, coraco-acromial ligament; *c*, coracohumeral ligament; *d*, transverse ligament; *e*, coracoclavicular ligament; *f*, anterior costosternal ligament; *g*, interclavicular ligament; *h*, anterior sternoclavicular ligament; *i*, costoclavicular ligament; *j*, capsular ligament (Dorland's Dictionary).

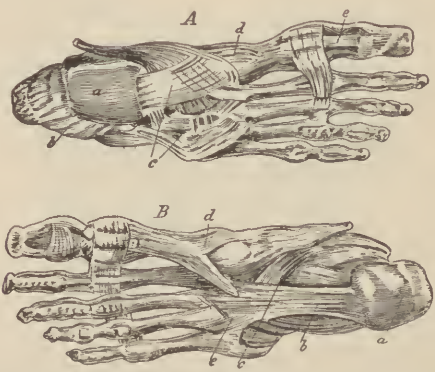


FIG. 29.—Ligaments of the foot: *A*, Dorsal aspect: *a*, Astragalus; *b*, calcaneo-astragaloid ligaments; *c*, dorsal ligaments or tarsus; *d*, tarsometatarsal ligaments; *e*, transverse ligaments *B*, Plantar aspect: *a*, Os calcis; *b*, greater calcaneocuboid ligament, *c*, deep calcaneocuboid ligament; *d*, inferior tarsometatarsal ligament; *e*, tarsometatarsal ligaments (Dorland's Dictionary).

"In these joints the articulating surfaces of the bones are covered with a thin layer of articular cartilage. This

cartilage is again covered with a membrane, known as the synovial membrane" (Furneaux).

FIG. 30.—Ligaments of the knee-joint: *A*, Anterior aspect: *a*, Femur; *b*, ligamentum patellæ; *c*, internal lateral ligament; *d*, external lateral ligament. *B*, Posterior aspect: *a*, Femur; *b*, posterior ligament; *c*, internal lateral ligament; *d*, external lateral ligament; *e*, posterior ligament of peroneotibial articulation; *f*, interosseous ligament (Dorland's Dictionary).

Cartilage is of two kinds: temporary, which is converted into bone in adults; permanent, which is not converted into bone.

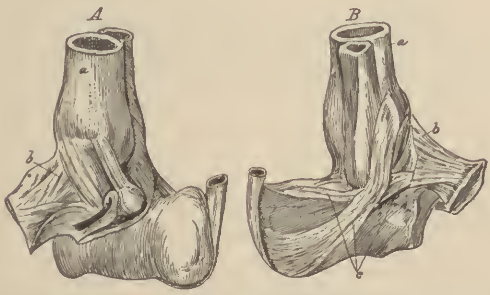


FIG. 31.—Ligaments of the ankle-joint: *A*, Internal aspect: *a*, Tibia; *b*, internal lateral ligament. *B*, external aspect: *a*, Tibia; *b*, anterior ligament; *c*, external lateral ligament (Dorland's Dictionary).

Cartilage in joints forms a strong yet yielding framework. It deepens the sockets of the joints; covers the

articulating surface of bone, reducing friction; acts as protective in lessening injury from shocks and blows.

Nervous Control of Muscles.—All muscular tissue is abundantly supplied with nerves, which convey impulses to the muscles from the central nervous system. Motor nerves have for their special function the control of muscular contraction and the producing of motion. "From the brain or spinal cord a nerve goes to every voluntary muscle in the body, and a branch of a nerve-fiber goes to each muscle cell. When you wish to make a certain movement the commands pass through the nerves to

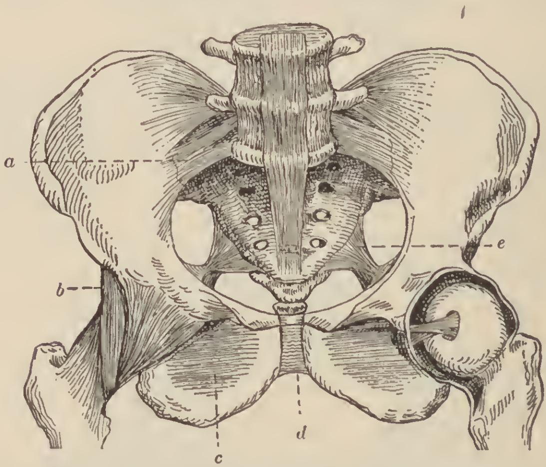


Fig. 32.—Front view of the pelvis, with its ligaments: *a*, Anterior sacro-iliac ligament; *b*, iliofemoral ligament; *c*, obturator membrane; *d*, symphysis pubis; *e*, sacrosciatic ligament (Dorland).

the proper muscles, the muscle cells contract, and the movement is made." (Ritchie.)

Fatigue, as a rule, occurs as a result of prolonged muscular contraction. This produces waste substances which accumulate and act as poisons, and also results in excessive loss of material needed for maintaining the tone

of the tissues. During rest periods the blood should be able to carry fatigue poisons to the organs which excrete them and also convey nutritive material from the digestive system to rebuild muscular tissue.

Special Membranes.—A membrane is a thin layer of tissue which covers a surface or divides a space or organ. Membranes have many distinguishing characteristics, but they may be broadly classified as follows:

1. Mucous.
2. Serous.
3. Cutaneous.
4. Synovial.

Mucous membranes constitute the lining of passages and cavities which have an opening to the exterior of the body. Their surfaces are covered by mucus, a viscid watery secretion from the mucous glands, which performs important functions in the body.

The functions of mucous membranes are, first, protection for the passages of the body which connect with the outer world. Foreign substances which would otherwise gain access to the body are prevented by the mucus, and are forced out with and by it.

They are abundantly supplied with blood-vessels, and assist in the important functions of circulation and absorption. This membrane lines the mouth, the alimentary canal, the air-passages, the kidneys, bladder, and the entire urinary tract. It also forms the lining of the vagina and uterus in the female.

Serous membranes are found lining organs and cavities of the body which do not have an opening to the exterior. These include the pleura, the membrane which covers the lungs and lines the chest; the pericardium, which covers the heart; the peritoneum, which lines the abdominal cavity. It is also found lining the cavities within the skull and spinal cord, and the internal coat of heart, blood-vessels, and lymphatics closely resembles the serous membrane in its structure. The chief function of the serous

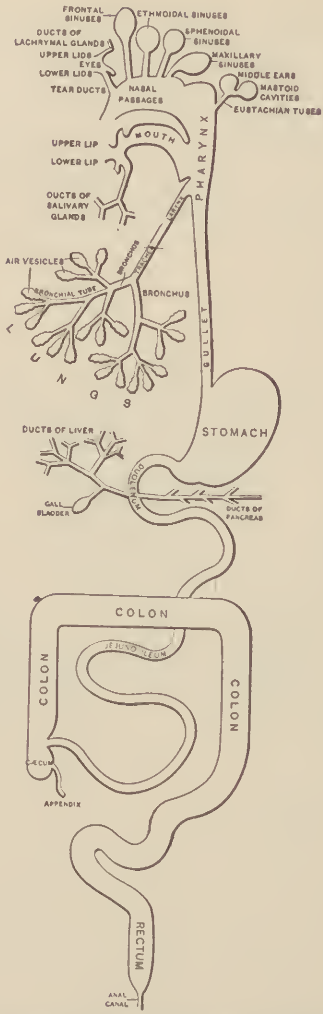


Diagram of the gastropulmonary mucous membrane, showing the continuity of all its parts. (From Gerrish, "Text-Book of Anatomy," Lea & Febiger, publishers.)

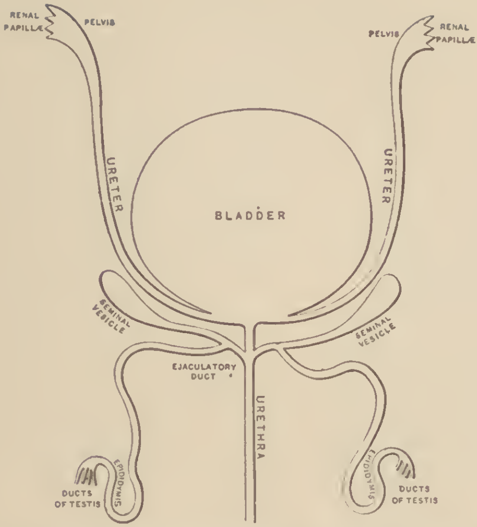


Diagram of the male genito-urinary mucous membrane, showing continuity of all its parts. (From Gerrish, "Text-Book of Anatomy," Lea & Febiger, publishers.)

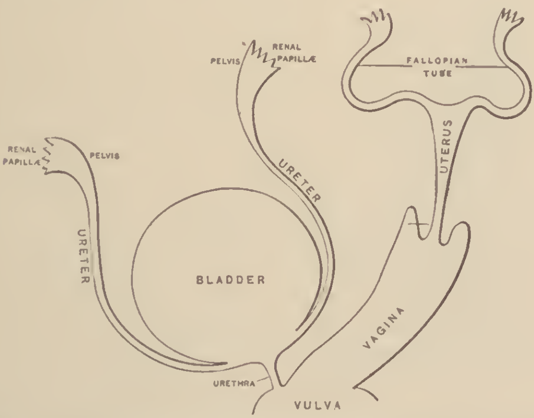


Diagram of the female genito-urinary mucous membrane, showing continuity of all its parts. (From Gerrish, "Text-Book of Anatomy," Lea & Febiger, publishers.)

membrane is protection. It secretes a serum which serves to lubricate the surfaces and thereby lessens friction.

The *cutaneous membrane* covers the body, and will be discussed in the chapter relating to the skin.

Synovial membranes are sometimes spoken of as serous membranes. Their function is the same, and they do not open to the exterior. They differ in their structure, in the character of the fluid they secrete, and are always associated with bones, muscles, and joints.

The fluid secreted by the synovial membranes is known as the *synovia*.

CHAPTER IV

THE ORGANS OF THE ABDOMEN AND PELVIS

The organs of the abdomen include—

- The esophagus (lower part).
- The stomach.
- The intestines.
- The liver.
- The pancreas.
- The spleen.
- The kidneys.

The organs of the pelvis are—

Male Pelvis.	*Female Pelvis.*
The rectum.	The rectum.
The bladder.	The bladder.
The prostate gland.	The uterus.
	The ovaries.
	The Fallopian tubes.
	The vagina.

The **esophagus** extends from the mouth or pharynx, a cavity or sac at the back of the mouth, to the stomach. It is the narrowest part of the food passage or alimentary canal, and is composed of thick muscular fibers, the inner coat of which pass around it in a circle. These fibers contract on food as it enters the tube and force it into the stomach. It passes through the diaphragm and is widened where it joins the stomach.

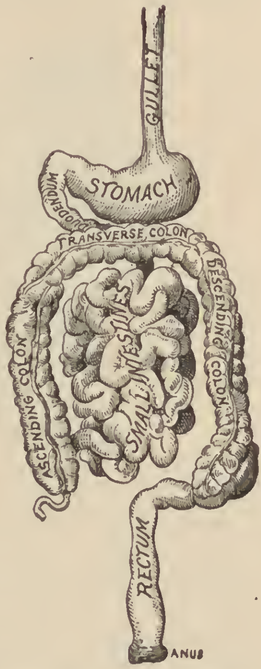


FIG. 33.—The alimentary canal (Stoney).

The **stomach** is a muscular sac measuring from 10 to 12 inches from right to left. In shape it resembles somewhat a curved flask, with the larger end toward the left. Its average capacity is about 5 pints. The larger end is called the cardiac extremity and the narrower end the pyloric extremity. The opening from the esophagus into the stomach is called the cardiac orifice, and the opening into the intestines, the pylorus. The right surface on the upper side comes in contact with the liver.

The *stomach walls* have four distinct coats. The outer or peritoneal coat is a layer of the peritoneum, a membrane which lines the inner surface of the abdomen and covers the organs. The next coat is muscular; the next is composed of areolar tissue, and the lining of mucous membrane.

The *mucous membrane* of the stomach is composed largely of very small glands which secrete the mucus needed to keep the surface moist and the gastric fluid

needed for digestion. It is estimated that from 10 to 20 pints of gastric fluid are secreted by the gastric glands in twenty-four hours.

FIG. 34.—The stomach (Morrow).

The stomach is the chief digestive organ of the body.

The *gastric fluid* secreted by the gastric or peptic glands consists of water, pepsin, common salt and other salts, and hydrochloric acid. It—

Dissolves nitrogenous foods.

Dissolves the albuminous walls of fat-cells and the tissues that connect them, thus liberating fats for digestion.

Converts albuminoids into peptones.

Converts foods into chyme.

Coagulates certain albuminous substances, such as the casein of milk.

Acts as an antiseptic.

The gastric fluid has no action on fats or starchy foods.

The **intestines** occupy a large portion of the abdominal cavity. These, like the stomach, have four layers in the wall; are from 25 to 30 feet long in the adult, and are divided into small and large intestines.

The *small intestine* is about 20 feet in length. The

upper part, which joins the pylorus, is called the duodenum —about 10 inches in length. The other two divisions of the small intestine are known as the jejunum and the ileum.

The *large intestine* is about 6 feet long and is divided into the cecum, the colon, and the rectum. Between

Fig. 35.—*A*, The ileocecal valve (Campbell).

the small and large intestines is a valve called the ileocecal valve, which allows the contents of the small intestine to pass downward, but resists passage from the large intestine upward.

The large intestine enlarges abruptly and joins the ileum at right angles. Close to the junction on the cecum side is a small fleshy tube closed at its free end, which is termed the vermiform appendix.

The *colon* has three divisions—the ascending, transverse, and descending colon.

The mucous or inner coat of the bowel, like that of the stomach, is composed largely of glands. These glands secrete mucus and certain fluids for digestion. To certain groups of these glands the term "Peyer's patches" has been given.

Peristalsis.—A continual worm-like motion of the intestine is kept up, to which the term "peristalsis" has been given. By means of this peristaltic action the

contents are kept in motion, mixed with the digestive fluids, and carried along.

The **liver** is a large organ, weighing from 3 to 5 pounds, located on the right of the abdomen. It is the largest

FIG. 36.—Portion of the wall of the small intestine, laid open to show the valvulæ conniventes (Brinton).

gland of the body and performs both the secretory and excretory function. It is in two lobes or parts, the right lobe touching the kidney and the left crossing the median line and partly covering the stomach. It is a complex

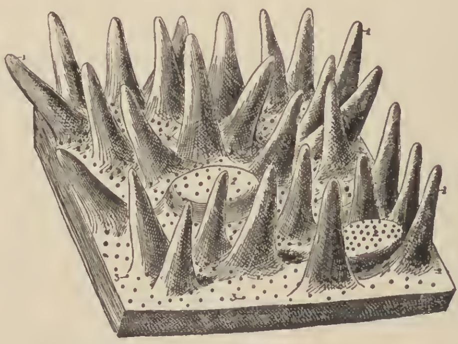


FIG. 37.—Mucous membrane of the jejunum, highly magnified (schematic): 1, 1, Intestinal villi; 2, 2, closed or solitary follicles; 3, 3, orifices of the follicles of Lieberkühn (Testut).

organ, having several different functions in the processes of the body. These functions are not yet wholly understood, but it is known that it—

Secretes bile.

Prepares glycogen.

Assists in the formation of urea and allied products.

Modifies the composition of the blood as it passes through it.

It has been said that "the liver acts as a sort of siding, into which are switched trains of both venous and arterial blood for a transfer of their freight." Its most important function is the secretion of bile. From 30 to 40 ounces of bile are secreted daily.

Bile is both a secretion and an excretion; it contains new constituents found nowhere else in the body, which

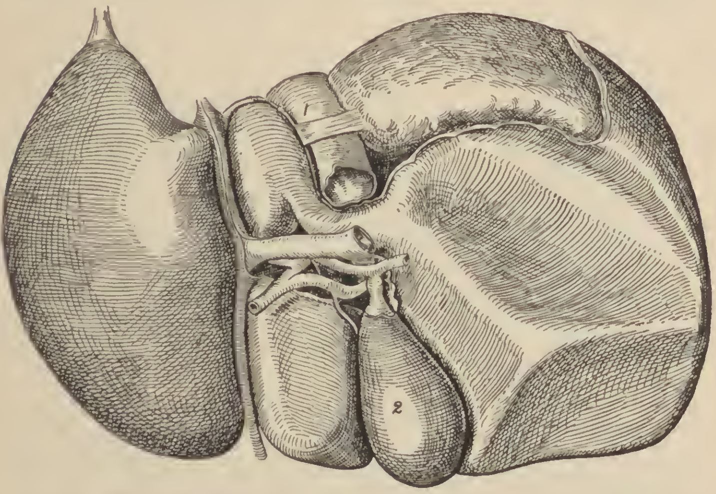


Fig. 38.—The liver, seen from below: 1, Inferior vena cava; 2, gall-bladder (Morrow).

play an important part in digestion; and also contains waste ingredients which are carried through a duct into the intestinal tract to be eliminated. It stimulates peristalsis and acts as a disinfectant to the bowel.

Glycogen is a substance resembling sugar and starch in composition. It contributes to the heat of the body.

The **gall-bladder** is a pear-shaped sac situated on the under surface of the liver. It acts as a reservoir for the

bile, which is carried from it into the duodenum by means of the common bile-duct.

The **pancreas,** commonly known as sweetbread, is a gland which lies behind the stomach, and extends from the duodenum to the spleen. Its function is the preparation of the pancreatic fluid, one of the digestive juices. This fluid is carried into the duodenum by the pancreatic duct.

The **spleen** or **milt** is a ductless gland which is believed to assist in producing some of the constituents of the blood. It is situated close to the cardiac end of the stomach, directly beneath the diaphragm.

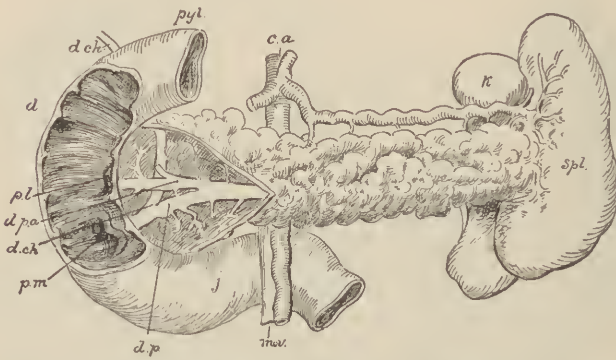


FIG. 39.—Pancreas dissected to show *d.p.*, pancreatic duct; *d.p.a.*, accessory duct; *d.ch.*, bile-duct. Duodenum laid open to show *p.m.*, papilla major; *p.l.*, papilla minor; *spl.*, spleen; *k.*, kidney; *j.*, jejunum; *m.v.*, mesenteric vessels; *c.a.*, celiac axis (Robson and Moynihan).

The **kidneys** are two bean-shaped organs situated in the back part of the abdomen, one on each side of the spinal column. They are organs of excretion, their function being to separate from the blood certain poisonous substances which have accumulated during its circulation through the body.

The *ureters* are two tubes leading from the kidneys

to the bladder. Their function is to convey the matter secreted by the kidneys, in the form of urine, to the bladder.

The *adrenals* or *suprarenal capsules* are two small flattened triangular-shaped bodies which rest on the upper part of the kidneys. The secretion from these glands performs a most important function in maintaining the normal tone of the body, and in the regulation of the blood-supply. Too much or too little activity in these small glands may produce disastrous results on the general health. (See pages 125, 126.)

The **bladder** is a strong membranous and muscular sac situated in the pelvis. It is a reservoir for the temporary reception of the urine and is composed of four coats. Its opening is controlled by a muscular band called a sphincter. The tube which conveys the urine from the bladder outward is the urethra. The outer opening of the urethra is called the meatus urinarius.

The **peritoneum** is a membrane which lines the abdomen and folds around all the organs. The part which connects the intestine to the abdominal wall is called the mesentery; that which is connected with the stomach, the omentum. The peritoneum is a closed sac, the interior of which is termed the peritoneal cavity.

The organs contained in the abdomen, when classed together, are termed the abdominal viscera.

The **abdominal region** is divided as follows:

The *epigastric region* is the region over the stomach.

The *umbilical region* is the middle region, and includes a portion of the abdomen immediately above and below the umbilicus.

The *hypogastric region* is the lower part of the abdomen.

The **rectum** is the lower part of the large intestine. Its length is from 4 to 5 inches. It follows the curve of the pelvic wall formed by the sacrum and coccyx. It joins the colon at that portion of the colon known as

the sigmoid flexure, where an abrupt turn or bend is made in the course of the bowel.

The *anal canal* is a term applied to the last $1\frac{1}{2}$ inches of the rectum, where it bends slightly to pass the point of the coccyx.

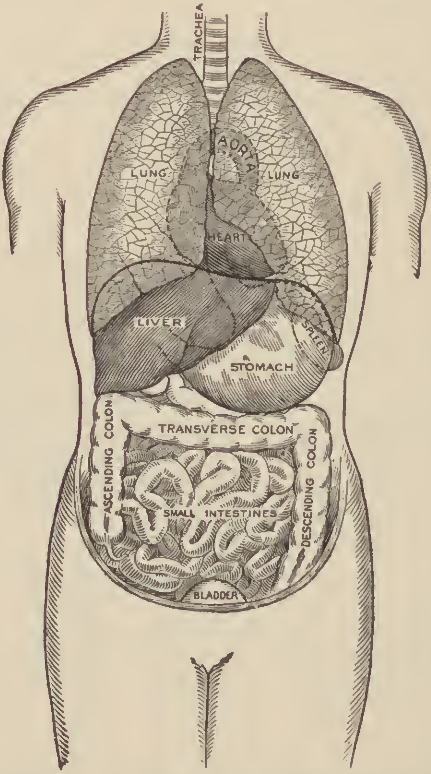


Fig. 40.—Position of the thoracic and abdominal organs, front view (Morrow).

The **anus** is the opening into the rectum. It is controlled by two muscles, known as the internal and external sphincters.

The Female Pelvis and Its Organs.—The female pelvis differs from the male, being shallower and more roomy.

Within the true pelvis are the female generative organs—the uterus, ovaries, Fallopian tubes, and the vagina, with which, for purposes of study, may be grouped the external genitals or vulva.

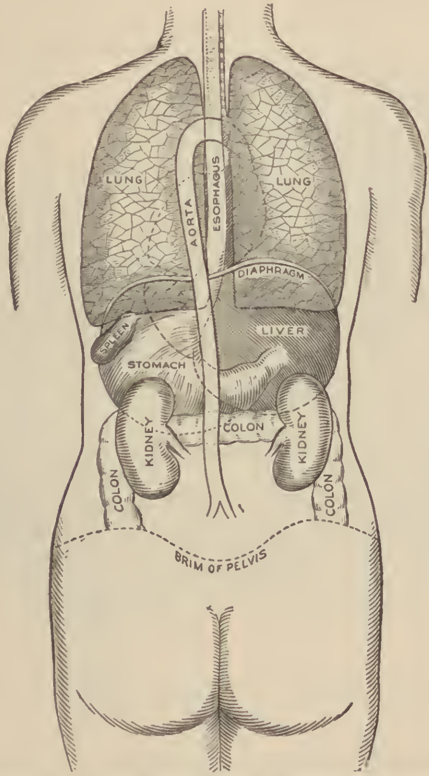


FIG. 41.—Position of the thoracic and abdominal organs, rear view (Morrow).

The *uterus* is a hollow, muscular, pear-shaped organ—from $2\frac{1}{2}$ to 3 inches in length and weighing about 2 ounces. It is located in the center of the pelvis, between the bladder and rectum, and is held in its place by ligaments. It receives the ovum, nourishes it after fertilization occurs,

and ultimately expels the fetus. It also furnishes the menstrual flow.

The *lining* is of mucous membrane. It is covered with "a microscopic down which has the function of automatic

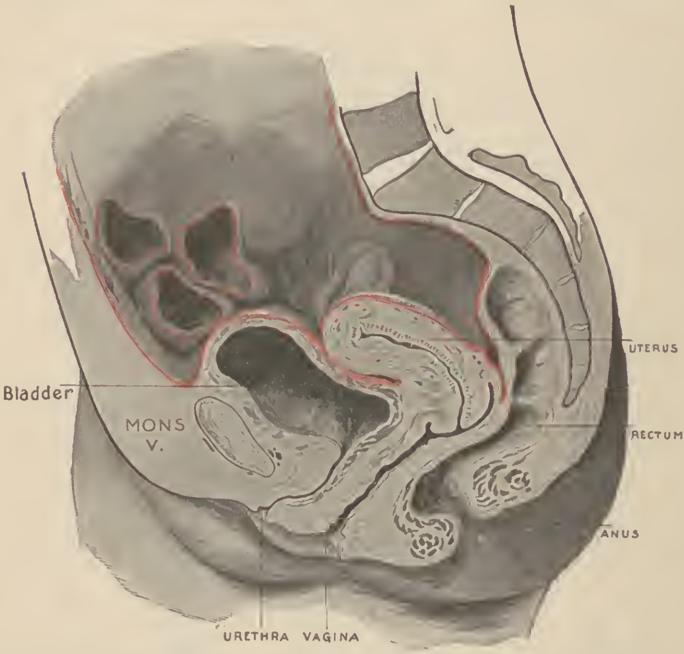


Fig. 42.—Section showing bladder, uterus, and rectum. Red line indicates the peritoneum (De Lee).

waving, thus moving any object lying on the surface." (De Lee.)

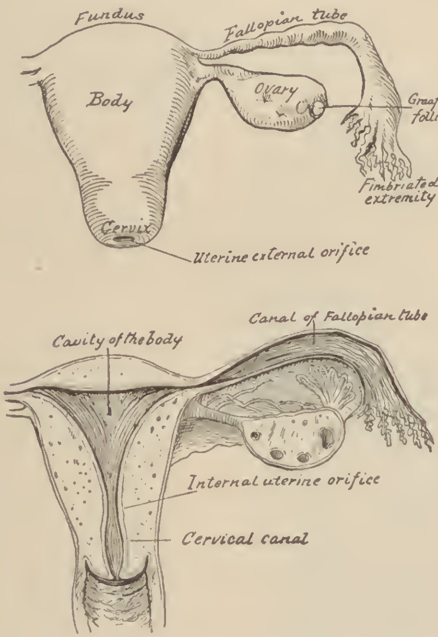
Arranged perpendicular to its surface are numerous tubular cells or uterine glands.

The **broad ligaments** are a part of the peritoneum, and extend from the sides of the uterus to the walls of the pelvis.

The **round ligaments** are cords of muscle from 4 to 5

inches long, extending downward and forward from the upper part of the organ until they become lost in the muscular tissues connected with the pubes.

The *uterus* is divided, for convenience of description, into three parts—the fundus, which is the broad upper portion of the organ, the body, and the cervix or neck. The opening in the cervix is called the *os*.



FIGS. 43, 44.—The uterus, ovary, and Fallopian tube (Macfarlane).

The *ovaries* are small oval-shaped bodies, located one on either side of the uterus and connected with the broad ligament. Their length is about $1\frac{1}{2}$ inches. They contain the ova or eggs, which are contributed by the female for the propagation of the species.

The *Fallopian tubes* are ducts or tubes which convey

the ova from the ovaries to the uterus. They open at one end into the uterus and, at the other, spread out in fringe-like processes known as the fimbriated extremity or fimbriæ. One of the fimbria is longer than the others, and is indirectly connected with the ovary by a fold of the peritoneum.

The *vagina* is a canal-like passage lying between the bladder and rectum. It is attached to the uterus at the middle of the cervix and terminates at the vulva.

The *perineum* is the name given to the fleshy wall that lies between the vagina and the rectum and anus. It is subject to great strain during childbirth, resulting in frequent lacerations, sometimes extending so deeply that the anus and rectum are torn.

CHAPTER V

RESPIRATION AND TEMPERATURE

Respiration has been defined as the inspiration and expiration of air or "the function by which oxygen is absorbed into the blood and carbonic acid exhaled. It is a part of the general nutritive process of the body, the blood, and respiratory organs, constituting the media by which the interchange of gases is accomplished."

"The *object of respiration* is to take oxygen into the body and to give off carbon dioxid from the body." (Ritchie.)

Inspiration is the taking in of air to the lungs as seen when the chest rises.

Expiration is the forcing of air out of the lungs as seen when the chest falls. The processes of inspiration and expiration together constitute respiration.

The *respiratory organs* are the larynx, trachea, and lungs. The mouth and nose are spoken of as the upper air-passages.

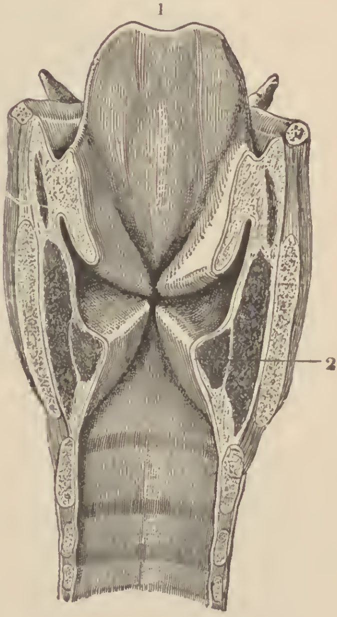


FIG. 45.—Interior of the larynx: 1, Epiglottis; 2, vocal cord; 3, cavity of the trachea (after Testut).

The framework of the chest and the muscles used in breathing are sometimes included in describing the respiratory system.

The **diaphragm** is an important muscle in the respiratory process. It is defined as a thin, dome-shaped muscle, with a center of connective tissue. The stomach and liver fit into the hollow of its lower surface. (See Fig. 47, p. 83.) In inspiration the diaphragm is drawn downward. The bottom of the chest cavity sinks; the ribs and sternum are drawn upward and widen outward. The drawing away of the chest walls and diaphragm from the lungs leaves a

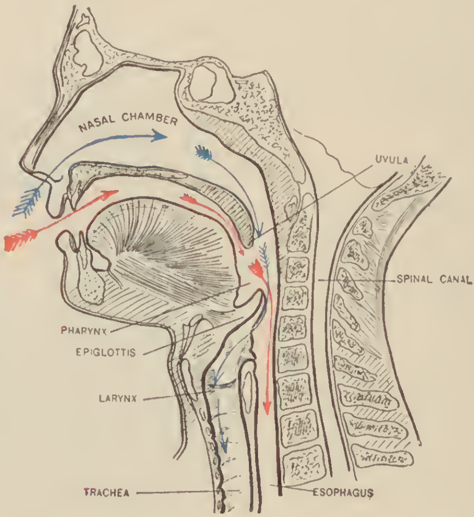


Fig. 46.—The air follows the path indicated by the blue arrows, and the food follows the path indicated by the red arrows. (From Ritchie's "Human Physiology," World Book Company, publishers.)

vacuum. The air is drawn into and expands the lungs. In expiration the diaphragm is forced upward.

The **pharynx** is a small funnel-shaped cavity behind the mouth.

The **uvula, a portion of the soft palate,** is found in front of the nasal openings separating the pharynx from the mouth. During swallowing it is pushed back over the nasal openings, and prevents food or water from entering the nose.

The **tonsils,** two in number, are found in the side walls of the pharynx. They are frequently the seat of active inflammation.

The **larynx** is the organ of voice, the upper part of the wind-pipe.

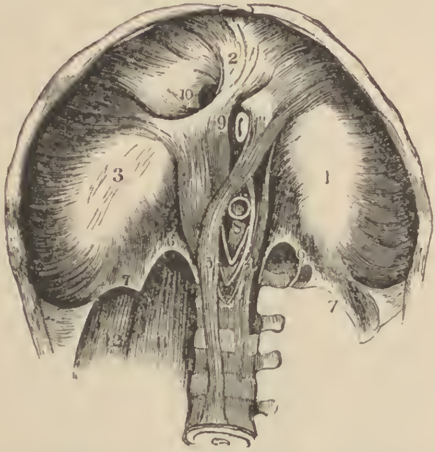


FIG. 47.—The diaphragm, inferior surface: 1, 2, 3, Central cordiform tendon; 4, 5, crura; 6, internal arcuate ligament; 7, external arcuate ligament; 8, aortic opening; 9, esophageal; 10, opening for vena cava (Leidy).

The **epiglottis** is a flap-like structure in front of and above the opening to the larynx.

The **trachea** or wind-pipe is a tube which passes downward from the throat into the thorax or chest. It consists of rings of cartilage connected by fibrous tissue. The lower part of the trachea divides into two branches, called bronchi, which lead to the lungs. They are differentiated as the right bronchus and the left bronchus.

The **bronchi** subdivide again and again until their branches reach every part of the lungs. In the trachea and bronchial tubes the mucous membrane which lines them consists of peculiar cone-shaped cells, the large ends of which are covered with very fine hairs. These hairs or hair-like processes of certain cells are called

cilia. They are constantly in motion in one direction, thus maintaining a constant current of the mucous secretion toward the mouth. Protection from dust is thus provided for the lungs, the dust being arrested in the mucus and carried to the mouth, where it is expelled.

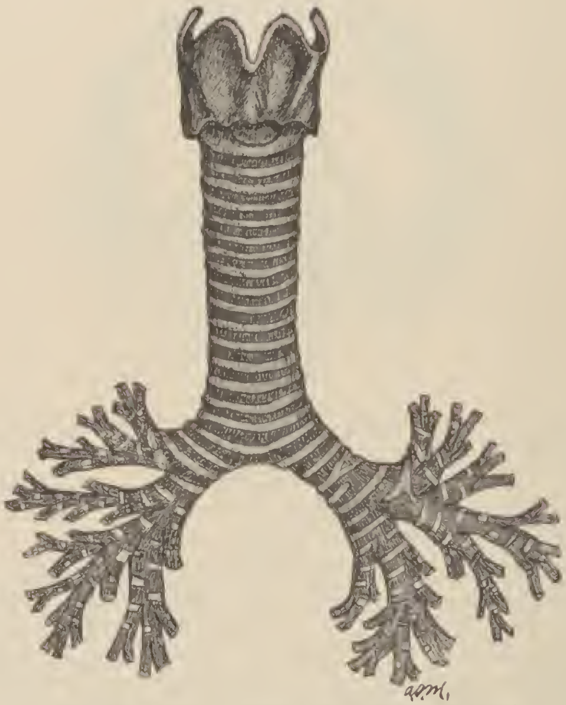


FIG. 48.—Larynx, trachea, and bronchi (Morrow).

The **lungs** occupy the larger portion of the thoracic cavity. They are two large spongy organs extending from the root of the neck about $1\frac{1}{2}$ inches above the collar-bone, to the diaphragm, which forms the floor of the thoracic cavity, or about to the sixth and seventh ribs. The lungs are unequal in size, the base of the right lung

being considerably curved by the bulging upward of the liver. The base of the left lung is also concave, or has a hollow curve, though not so deep, because of the upward projection of the stomach, the left lobe of the liver, and the spleen.

The *right lung* is larger, broader, nearly 2 inches shorter than the left, and weighs about 2 ounces more. It is

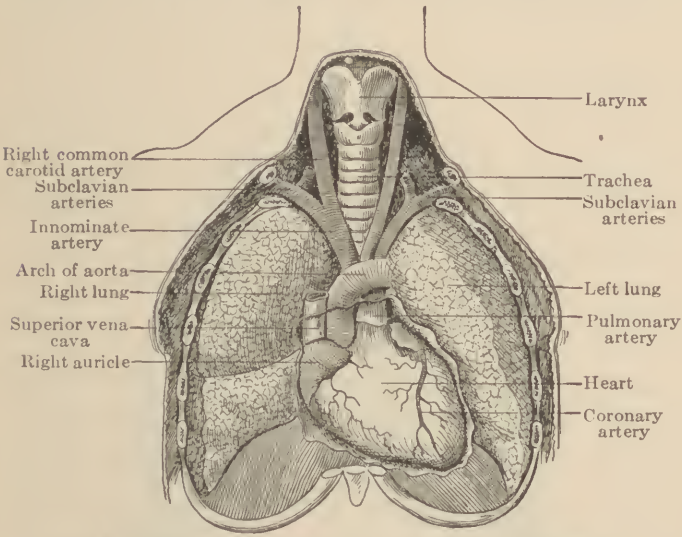


FIG. 49.—Relation of lungs to other thoracic organs (Ingals).

divided by deep fissures into three lobes, and the left into two. The lungs are covered by a double membrane, called the pleura.

"The **pleuræ** are two thin, double-walled sacs. The outer layer of a pleura is attached to the chest wall and diaphragm, and stretches as a partition across the thoracic cavity from top to bottom. The inner layer encloses the lung. This layer of the pleura is very delicate and forms a thin coat over the surface of the lung. The surfaces of the pleuræ are kept moist with a thin yellowish liquid.

This prevents friction when the two layers of the pleura move on each other in breathing.

"In *pleurisy*, or inflammation of the pleura, considerable quantities of fluid may collect between the layers of the pleuræ." (Ritchie.)

The *pulmonary tissue* is made up largely of small cells and capillaries, together with the bronchial tubes. Bands of yellow elastic tissue connect these several elements.

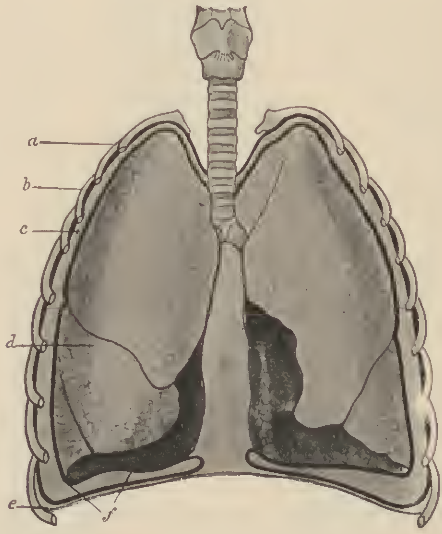


Fig. 50.—Diagram of pleural cavities: *a*, Ribs; *b*, costal pleura; *c*, pleural cavities; *d*, lungs; *e*, diaphragm; *f*, pulmonic pleura (McCombs).

These cells are arranged in small groups, called lobules, and attached to the termination of the bronchioles, the term given to the termination of the bronchial tubes in the air cells. Underneath this thin membranous lining of the air cells is a close network of capillaries so small that it is said but a single blood corpuscle can pass through a vessel at once. It is estimated that there are about eighteen million of these air cells. Through this

thin film of tissue, which is exposed to the air on both sides, the whole amount of the blood of the body flows three times a minute. For the aëration and purification of the blood and ventilation of the body it is estimated that about 12,000 quarts of air each day are necessary, though the entire volume of air passing in and out of the lungs in twenty-four hours is subject to great variation.

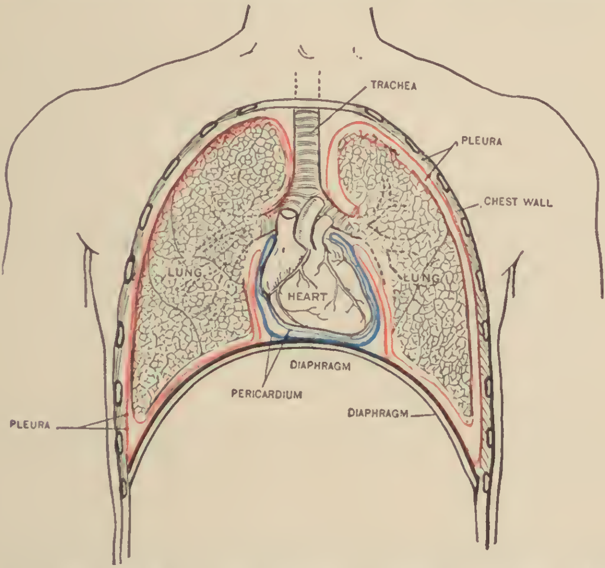


FIG. 51.—The pleuræ. (From Ritchie's "Human Physiology," World Book Company, publishers.)

The **normal respiration** is about in the ratio of 1 to 4 of the heart-beats. In inspiration the thorax is enlarged by the lowering of the diaphragm, the elevation and distention of the ribs, and the distention of the elastic tissue of the air cells. In expiration this process is reversed.

The *power of chest expansion* may be diminished by compression or by lack of use of the muscles involved, just as want of exercise in other muscles of the body will

result in a weakening and wasting of muscular tissue. The lung tissue also may lose its elasticity by habitual neglect or obstruction of normal expansion.

Air is a combination of numerous gases, of which the chief are oxygen and nitrogen. Other gases in minute quantities are found in it, of which the most important is carbonic acid or carbon dioxid. A certain proportion of watery vapor is also contained in it.

Oxygen is essential to animal life. The nitrogen serves the purpose of diluting the oxygen, which in its pure state, if inhaled for any length of time, would create disturbance in the system. Carbonic acid is found in the air as the result of decomposition of animal and vegetable substances. It is essential to plant life, but in large quantities is destructive to human life. The watery vapor of the air moistens the oxygen and enables the lungs to utilize it more readily.

Tidal air, or the breathing volume of air, is that which passes in and out of the lungs with each respiration.

Complemental air is that which can be taken into the lungs by a forced inspiration.

Residual air is that portion which remains in the chest and cannot be expelled after the most forcible efforts at expiration.

The *quantity of oxygen* consumed in a day is subject to great variation. It is increased by exercise, digestion, and a low temperature, and decreased by opposite conditions.

The exhalation of carbonic acid is increased by active muscular exercise, by age, and by certain foods and beverages. It is decreased by lack of exercise, certain forms of stimulation, and by dryness of the atmosphere.

Watery vapor passes out from the body through the lungs with expired air to the amount of from 1 to 2 pounds daily.

Asphyxia is oxygen starvation. When the supply of oxygen to the lungs is cut off or diminished, the carbonic

acid is retained in the blood. Normal breathing ceases and death occurs unless the condition is relieved.

Foods when oxidized (burned) within the body cells, unite with oxygen, with the result that new energy is given to the cells. Oxygen is necessary for the burning of all substances. If a lighted candle be placed under an inverted glass it will soon go out because the oxygen in the vessel is exhausted. Likewise body cells will die if deprived of oxygen.

Temperature.—The chemical elements of the body are always undergoing a change. The foods supplied to the body undergo a form of combustion similar in many respects to the chemical changes which take place in coal, wood, or other fuel when brought into contact with heat-producing chemical substances.

Oxidation has been defined as the process of combining with oxygen; of adding oxygen to or of subjecting to the action of oxygen. In all forms of oxidation heat is generated. The temperature of the body is maintained by the opposing chemical processes, heat production and heat elimination. By means of the blood the oxygen and the nutritive material to be oxidized are carried to all the cells and tissues of the body. Muscular exercise increases heat production. During sleep less fuel is consumed and less heat generated.

Heat elimination is accomplished by means of the skin, the mucous membranes which are exposed to the air, and the loss of warm body substances, such as the excretions. The temperature of the surrounding atmosphere is lower than the body temperature, and, by contact with the surface of the body, assists in preventing the accumulation of heat. The balance of body heat is controlled by the nervous system. When this balance is disturbed, the temperature changes, though there is a definite cycle of normal variation each day. In certain forms of fever the action of the poison causes more rapid burning up of tissues and, consequently, higher temperature. Heat

elimination or loss is accomplished to a large extent by means of the arteries, which are close to the surface of the skin. Cold has the effect of contracting them. When the body surface becomes thoroughly chilled, the blood-vessels nearest the skin contract, the escape of heat through the skin is lessened, and the heat remains in the system, causing an elevation from the normal temperature.

There is, however, a normal variation of temperature during the twenty-four hours. At night, when the vital activity of the body is least, the temperature will be found lowest. This occurs usually between 2 and 6 A. M. The average normal temperature of the body is 98.6° F., but it varies not only with the time but with the locality in the body. The variation is usually but a fraction of a degree.

Temperature is also influenced by age; that of a child being, as a rule, somewhat higher, and in advanced age lower than the normal average. In children the system is very easily thrown out of balance, the equilibrium of the vital machinery being more or less in an unstable condition. In aged persons circulation is less active and tissue changes somewhat slower than in earlier adult life.

Exercise, temperament, mental condition, food, and atmospheric conditions may all exercise a modifying effect on the temperature in health, and are quite liable to in disease.

The most common causes of rise of temperature are the toxins of bacteria.

The term "*crisis*" is used to denote a condition in which the temperature falls from a high point to normal within about twelve hours.

The term "*lysis*" is used when the fever and other disease symptoms subside gradually.

CHAPTER VI

THE BLOOD AND CIRCULATORY SYSTEM

THE BLOOD

THE *blood* is a nutritive fluid composed of a transparent colorless liquid, called plasma, in which float red and white corpuscles.

The *red corpuscles* are much more numerous than the white. Their function is to absorb oxygen and carry it to the tissues.

Hemoglobin is the coloring-matter of the corpuscles. The color depends on the combination of the hemoglobin with oxygen. When oxygen is present in sufficient quantities the blood assumes a bright red hue and is

FIG. 52.—Cells of blood: *a*, Colored blood-corpuscles seen on the flat; *b*, on edge; *c*, in rouleau; *d*, blood-platelets (Leroy).

known as arterial blood. When the oxygen is lessened in the circuit of the blood through the tissues, the color changes to a dark purple and is known as venous blood.

The *white corpuscles* (also called *leukocytes*) number about 1 to every 500 of the red corpuscles. They are capable of changing both form and place, and readily pass through the walls of the blood-vessels.

The white corpuscles, besides contributing to the formation of new tissue, are believed to act as protectors to the body in destroying harmful substances that are formed in, or gain admission to, the system.

When outside of the blood-vessels they may undergo changes, and are said to assist in the formation of the new tissues where inflammation is present.

The *plasma* consists chiefly of water which holds in solution proteid substances, certain mineral salts, and the elements from which fibrin is formed. The plasma carries nutritive material to the tissues. The red corpuscles carry oxygen.

The Lymph.—"The blood-plasma soaks through the thin walls of the capillaries and passes out among the body cells. After the plasma is outside of the capillaries it is called lymph. The lymph surrounds all the cells in the body and fills the spaces between the cells. A fresh supply of lymph is constantly escaping from the blood

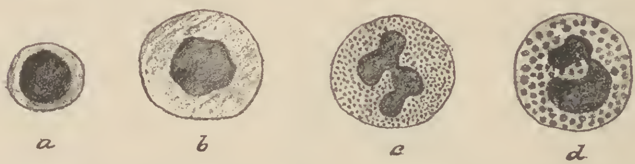


Fig. 53.—Various forms of leukocytes: *a*, Small lymphocyte; *b*, large lymphocyte; *c*, polymorphonuclear neutrophile; *d*, eosinophile (Leroy).

and the amount of lypmh in the body is several times as great as the amount of blood."

The *function of the lymph* is to receive food and oxygen from the blood and pass them on to the cells, and to receive the waste from the cells and pass it on to the blood.

The Lymphatic Vessels.—"The lymph flows into the lymph capillaries which form a network among the cells. The capillaries unite and form larger vessels which finally empty the lymph back into the blood." (Ritchie.)

Fibrin is essential to the coagulation or clotting of blood. The amount of fibrin differs widely in different individuals. In some persons it is so deficient that alarming hemorrhages result from very slight causes.

The chief functions of the blood are:

To convey the nutrition derived from foods to the tissues.

To convey materials for secretions to the glands which prepare them.

To carry oxygen to the tissues.

To collect waste matter and carry it to the excretory organs for removal.

To distribute heat through the system.

To keep the tissues of the body moist.

In an adult of average size the amount of blood is estimated at about 8 pounds. About one-twentieth of the body weight is the ordinary proportion.

THE CIRCULATORY SYSTEM

The circulatory system consists of the heart and a system of closed vessels—the arteries, veins, and capillaries.

The **heart** is a hollow muscular organ, pyramidal in shape, situated in the thoracic cavity, between the lungs. Its weight is from 9 to 12 ounces. Its base is directed upward, backward, and slightly to the right. Its apex is downward, pointing to the left.

Cavities.—It is divided into four cavities, termed the right and left auricles and the right and left ventricles.

The heart is lined by a serous membrane, called the endocardium and surrounded by the pericardium.

The heart is a pump, which by its continuous action distributes nutritive matter to all portions of the body, and carries waste substance to the excretory organs.

The *auricles* are the upper chambers of the heart which receive the blood.

The *ventricles*, or lower chambers, expel the blood. The left side always contains pure blood, the right, impure.

Valves.—The *tricuspid valve* guards the opening between the right auricle and the right ventricle.

The *bicuspid valve* guards the opening between the left auricle and ventricle. This valve is also called the mitral valve.

The *semilunar valves* connect the ventricles on the right with the pulmonary artery; on the left with the aorta, the main trunk of the arteries. These valves

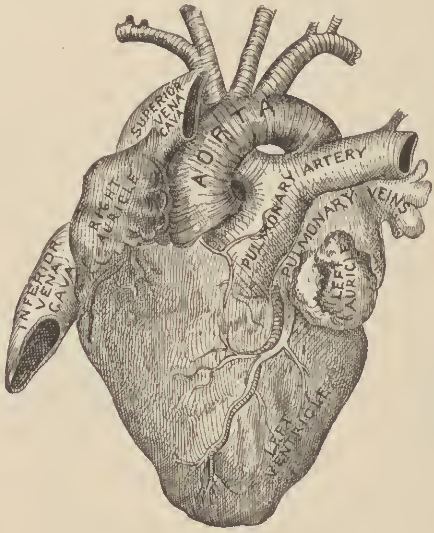


FIG. 54.—The heart (Stoney).

permit the blood to flow only in one direction—away from the heart.

The *auricles* receive the blood which is poured into them from the great veins. As they become filled they contract, forcing the blood downward into the ventricles.

The *ventricles* also contract, forcing it into the arteries. Regurgitation is prevented by the connecting valves.

The contractions are regular, each being followed by a slight period of rest, during which the chambers are being dilated with blood. The dilation is called the diastole and the contraction the systole.

Heart Sounds.—The rhythmic action of the heart causes two distinct sounds, which follow each other

closely and differ in character. The first sound is a comparatively long dull sound, caused by the contraction of the ventricles and the closing of the tricuspid and mitral valves.

The second sound is short and sharp, occurs during the diastole, and is caused by the closing of the semilunar valves.

Certain changes which take place in the valves as the result of disease tend to produce abnormal sounds which are characterized as "murmurs." Failure of a valve to

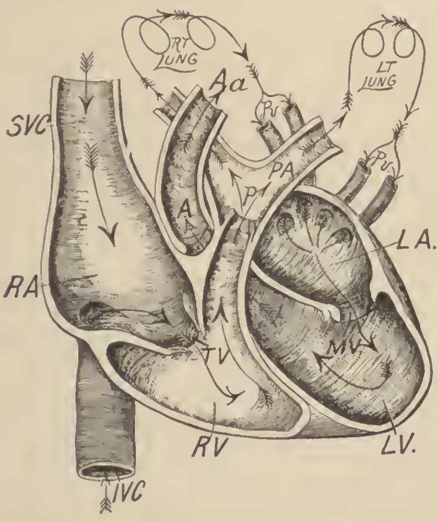


Fig. 55.—The circulation of the blood through the heart: *IVC*, Inferior vena cava; *SVC*, superior vena cava; *RA*, right auricle; *TV*, tricuspid valves; *RV*, right ventricle; *P*, pulmonary valves; *PA*, pulmonary artery; *Pv*, pulmonary veins; *LA*, left auricle; *MV*, mitral valves; *LV*, left ventricle; *A*, aortic valves; *Aa*, arch of aorta (Page).

close perfectly, allowing a part of the blood to flow backward, is called regurgitation, a common form of heart disease.

The **pulse** is the sudden distention of an artery, due to the volume of blood forced into it at the time of the

contraction of the ventricles. The vessels always contain a certain amount of blood, and in order to receive the incoming volume must expand. This expansion of the arteries occurs about seventy-two times in a minute in adult life.

BLOOD-VESSELS

The arteries, veins, and capillaries comprise the system of blood-vessels through which the blood circulates.

Arteries.—The arteries have three coats, forming a strong elastic wall. Proceeding from the heart, the arteries divide into two branches, and these divide and subdivide into smaller vessels, till they finally give rise to the capillaries, the smallest blood-vessels.

"As age advances the arteries lose their elasticity, and become more or less rigid from changes taking place in their coats. It is this change which has given rise to the expression, 'a man is as old as his arteries'; for a man of forty may have arteries which are similar to those we would expect to find in a man twenty years older." (Watson.) Arteriosclerosis or hardening of the arteries is the direct or indirect cause of a very large number of deaths.

Capillaries.—The walls of the capillaries are exceedingly thin, so that fluids readily pass through them. They are arranged like a network, and the changes which take place in the blood in its course through the body take place chiefly in these vessels.

In these tiny vessels the blood flows very slowly; the plasma soaks through their walls, furnishing new food to the tissue-cells and taking up much of the waste matter which these cells have excreted.

Veins are in structure similar to arteries, but the walls are thinner. Most of the veins are provided with valves (Fig. 57) which allow the blood to flow freely toward the heart, but resist any tendency to the flow in the opposite direction. Veins carry the blood back to the heart. They are situated close to the surface of the body. Arteries are deeper seated.

"The forces keeping the blood in circulation are:

"Action of the heart.

"Elasticity of the arteries.

"Capillary force.

"Contraction of the voluntary muscles upon the veins.

"Respiratory movements.

"The time required for a complete circulation of the blood throughout the vascular system has been estimated to be from twenty to thirty seconds, while for the entire mass of blood to pass through the heart, fifty-eight pulsations would be required, occupying about forty-two seconds." (Brubaker.)

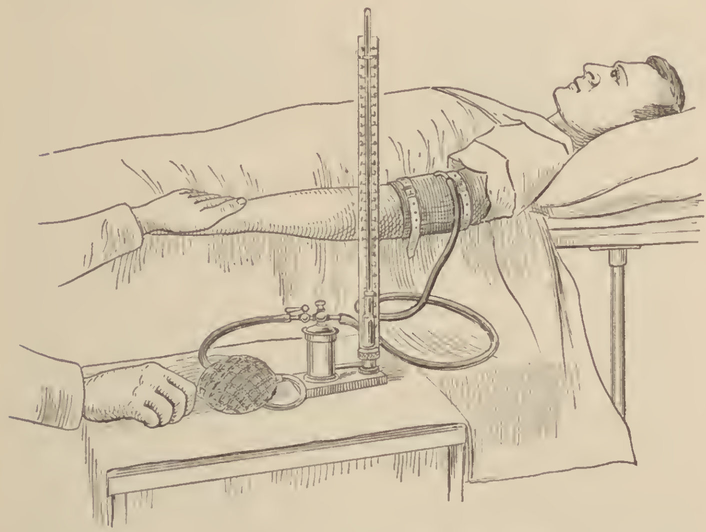


Fig. 56.—Testing the blood-pressure with the Stanton instrument (Morrow).

Blood-pressure.—By this is meant "the tension in the walls of the blood-vessels derived from the blood-current." (Dorland.)

For testing the blood-pressure an instrument known as a sphygmomanometer is used. The average blood-pressure

in an adult in normal health is between 120 and 140. In children it is lower, and as age increases it becomes higher. In certain forms of disease, where the blood-pressure is high, it sometimes rises to between 200 and 300. The pressure is estimated in millimeters on a scale marked on the sphygmomanometer. In general practice only the arterial pressure is registered. The usual average systolic pressure for normal adults is taken as "100 plus the age in years." It will thus be seen that the normal blood-pressure rises with advancing age. At twenty it is 120, at fifty it is 150, and at eighty is 180, roughly speaking. Moderate variations on either side of the average are common and without special significance. Moderate exercise and even a recent meal may cause a slight increase. "Increasing blood-pressure is almost the common fate of every man with advancing years, and associated with it is a weakening of the elastic wall of the blood-vessels. The blood, moreover, attains with age an increased adhesiveness to the vessel wall, slackening its flow and banking up the increased pressure. Worry, the stress and strain of life, overeating and drinking, poisons, too, both chemical and morbid, and the wear and tear from overwork, all tend to bring about this condition of high blood-pressure. The next act in the drama is nature's timely warning that we are exceeding the speed limit. This may take the form of a slight departure from usual health and efficiency or be of more serious intent. The most serious thing that can happen, of course, is for a blood-vessel in the brain—a structure that lends but little support—to give way." This is known as apoplexy. Paralysis, partial or complete, follows, and sudden death from this cause is common.

Low blood-pressure is often found in persons of low general vitality. It is present in surgical shock during chloroform anesthesia and in certain diseases.

Important Blood-vessels.—The *aorta* is the largest artery and leads from the left ventricle. It receives the pure blood from the lungs.

The *right* and *left pulmonary arteries* lead from the right ventricle. These convey blood from the right side of the heart to the lungs.

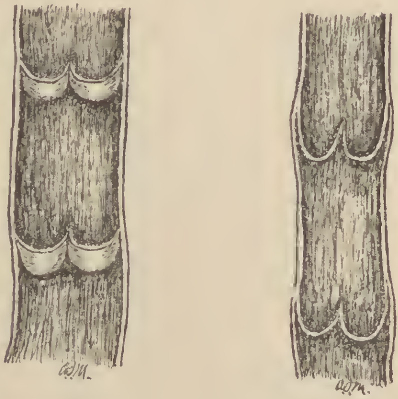


FIG. 57.—Diagram of the valves of veins (Morrow).

The *pulmonary veins* communicate with the left auricle. These collect the blood after it has circulated in the lungs and convey it into the left cavity.

The *inferior* and *superior vena cavæ* are two large veins communicating with the right auricle. They collect the impure blood from all parts of the body and convey it into the right cavity of the heart.

The *coronary arteries* are the arteries which supply the heart with blood for its own nourishment. They commence just outside the semilunar valves. The coronary veins collect the blood. These two sets constitute what is known as the coronary system, or the circulation within the heart itself.

The *common carotid arteries* are located one on each side of the neck close to the trachea, and carry the blood to the head and neck.

The *temporal artery* supplies branches to the head and scalp.

The *subclavian arteries* are the beginning of the long

trunks which form the chief arteries of the upper extremities.

The *radial artery* passes down on the inner side of the forearm to the hand. It approaches the surface above the wrist, where the pulsation may be felt.

The *femoral artery* is another in which pulsation may be felt. It is a continuation of the external iliac and is

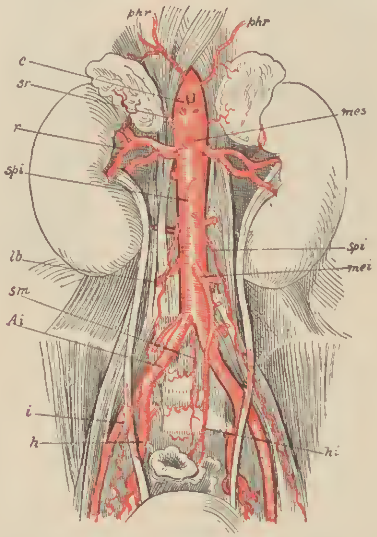


FIG. 58.—The abdominal aorta: *Ai*, Common iliac; *i*, external iliac; *h*, internal iliac; *sm*, middle sacral; *phr*, inferior phrenic; *lb*, lumbar; *c*, celiac; *mes*, superior mesenteric; *mei*, inferior mesenteric; *sr*, capsular; *r*, renal; *spi*, internal spermatic; *hi*, internal hemorrhoidal (after Henle).

found in the upper thigh on the inner side. Close to it lies the femoral vein. Arteries in which pulsation may be felt are the carotid, temporal, radial, and femoral.

Veins are spoken of as deep and superficial, the deep veins accompanying arteries, the superficial collecting blood from the skin and superficial structures.

The *jugalar veins*, situated on each side of the neck, receive the blood as it returns from the head and face.

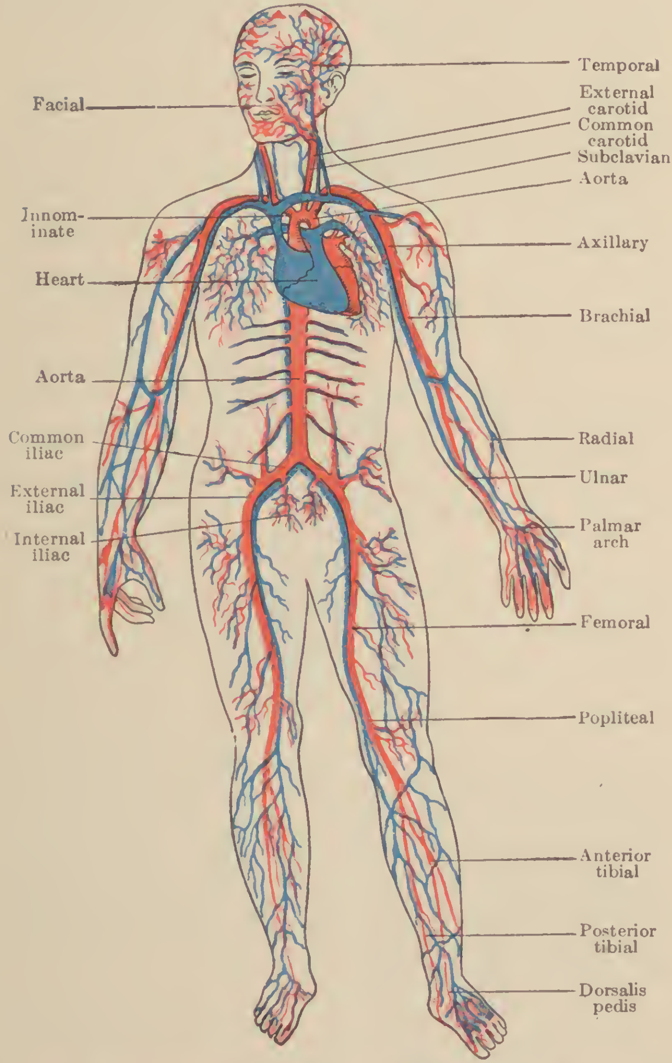


FIG. 59.—The principal arteries and veins of the body (Morrow).

These unite with the other veins to form the superior vena cava, the large vein through which the blood from the upper portion of the body reaches the heart.

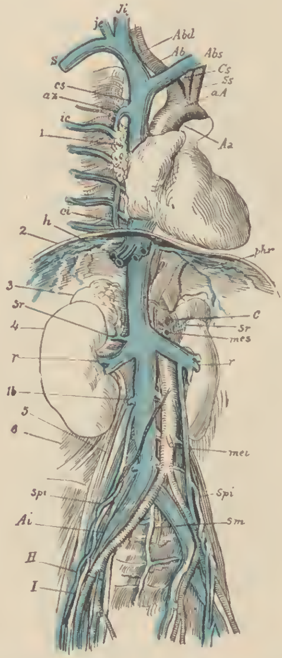


FIG. 60.—Veins and arteries of the thoracic and abdominal cavities: 1, Root of right lung; 2, section of diaphragm; 3, suprarenal body; 4, kidney; 5, psoas magnus muscle; 6, quadratus lumborum muscle; *Aa*, descending aorta; *aA*, arch of aorta; *Ab*, innominate artery; *cs*, left carotid artery; *Ss*, left subclavian artery; *c*, celiac artery; *mes*, *mei*, superior and inferior mesenteric arteries; *cs*, *ci*, superior and inferior venæ cavæ; *Abd*, *Abs*, right and left innominate veins; *S*, subclavian vein; *je*, *ji*, external and internal jugular; *az*, azygos vein; *ic*, intercostal vein; *h*, hepatic veins; *phr*, phrenic vein and artery; *sr*, suprarenal vein; *r*, renal artery and vein; *lb*, lumbar vein; *spi*, internal spermatic artery and vein; *sm*, middle sacral artery and vein; *ai*, common iliac artery and vein; *H*, hypogastric artery and vein; *I*, iliac artery and vein (after Henle).

The inferior vena cava carries the blood from the lower part of the body back to the heart.

Course of the Blood.—When the blood has been collected

by the vena cavæ from all parts of the body, it pours itself into the right auricle, then passes into the right ventricle, then through the pulmonary arteries into the lungs, where it gives up carbonic acid gas and takes in oxygen. After circulating through the capillaries of the lungs, it is taken up by the pulmonary veins, and carried to the left auricle and downward into the left ventricle. The contraction of this ventricle forces it into the aorta and its branches, where it circulates, by means of the capillaries, into all the tissues except the outer layer of skin, hair, and other bloodless parts of the body. The veins then take up and carry it back to the vena cavæ, and through these it passes into the right auricle, from whence it started.

The *nerve-supply* of the blood-vessels is received through the vasomotor nerves, which are connected with the sympathetic system and are distributed to the muscle-fibers of the vessels.

Vasoconstrictors cause the blood-vessels to contract, thus reducing the size.

Vasodilators cause the blood-vessels to dilate.

The pallor of fright is due to the action of the vasoconstrictor nerves, while blushing is due to the vasodilators.

Heat stimulates the vasodilators so that more blood goes to the skin.

Cold stimulates the vasoconstrictors and the blood is kept from the surface of the body.

CHAPTER VII

DIGESTION AND ABSORPTION

Digestion is the process by which the food introduced into the body is liquefied, and its nutritive principles changed by digestive fluids into a condition in which it is capable of being absorbed into the blood.

The **mouth** or **buccal cavity** contains the tonsils, tongue, salivary glands, and teeth. The palate forms the roof of the mouth. The hard palate serves as a partition between mouth and nose. The soft palate forms a curtain between the mouth and pharynx. The center of the lower portion of the soft palate extends in pointed form, and is called the uvula.

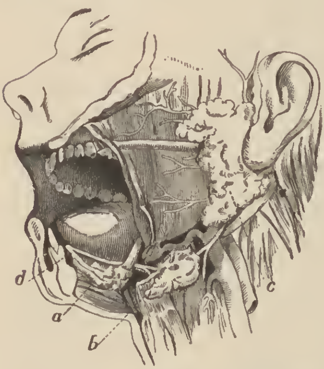


FIG. 61. Dissection of the side of the face, showing the salivary glands: *a*, Sublingual gland; *b*, submaxillary gland, with its duct opening on the floor of the mouth beneath the tongue at *d;* *c*, parotid gland and its duct, which opens on the inner side of the cheek (after Yeo).

The salivary glands are compound glands, and are distinguished by the terms *parotid*, *submaxillary*, and *sublingual*. The submaxillary and sublingual glands are located below the jaw and under the tongue. The parotid is under and in front of the ear. These glands secrete the saliva, which is an important ingredient in digestion.

The process which food undergoes has been divided into the following stages: Prehension, mastication, insalivation, deglutition, gastric and intestinal digestion, and defecation.

The Digestive Apparatus.—The organs or parts of the body which constitute the digestive machinery are the

teeth, the alimentary canal and its appendages, the liver, and pancreas.

After the foods have been finely divided by the teeth, their digestion is accomplished by means of substances known as enzymes or digestive ferments, of which there are a number of different kinds, each by its contact with

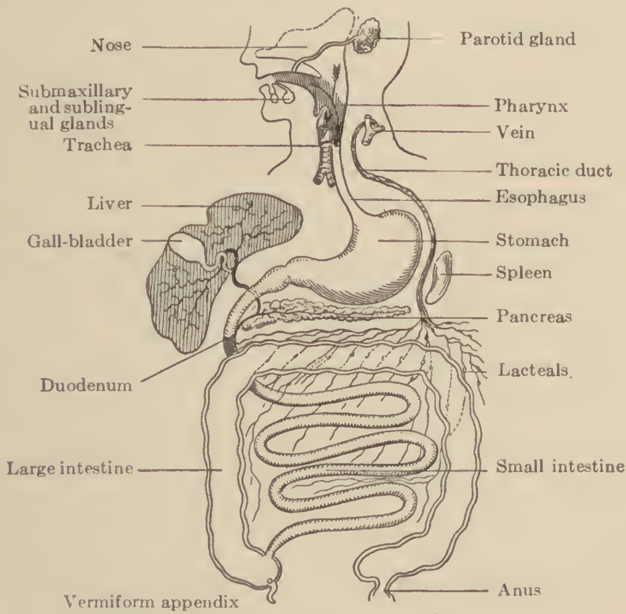


FIG. 62.—General scheme of the digestive tract, with the chief glands opening into it (Raymond).

the food effecting some chemical change in the intricate process of digestion.

The **function of the teeth** is to masticate or reduce the food to a finely divided condition, so that each particle of it may come in contact with the digestive fluids. The adult teeth number thirty-two. These consist of four incisors, two canines, four bicuspids, and six molars in each jaw.

The ease with which gastric digestion is carried on depends largely upon the thoroughness in masticating.

Insalivation is the mixing of the food with the saliva secreted by the salivary glands of the mouth. The active element or principle of the saliva is the ferment known as ptyalin.

The part performed by the saliva in digestion is the moistening and softening of all the food and the partial digestion of starches by the changing of starch into sugar. Starch is an insoluble substance and cannot be used in the body unless reduced to a liquid state. The action of the ptyalin accomplishes this change. From 1 to 2 pounds of saliva is secreted daily.

Deglutition is the act of swallowing.

Gastric Digestion.—When there is no food in the stomach to be digested, the mucous membrane which lines it is covered with mucus and is pale in color. The introduction of food or any substance has the effect of stimulating the whole organ to activity. The blood-vessels dilate and more blood is sent to that part, changing the mucous membrane to a bright red color. The multitudes of small tubular glands which are embedded in the mucous membrane begin to pour their secretion into the stomach, and this secretion of gastric juice continues while the food remains in the stomach. This organ, during digestion, exerts a muscular action which by slow, regular, wave-like contractions keeps the food in motion. By this means it becomes thoroughly mixed with the gastric juices, and as soon as any part of the food is digested, it is carried along through the pylorus into the small intestine. The nerve supply of the stomach is of a very complex nature, and its activity is greatly influenced by nervous excitement of any kind.

The *gastric fluid* has for its principal action the digestion of proteid substance. Albuminoid or proteid matter cannot pass through an animal membrane until changed into a solution known as peptones. This process of peptonizing proteids is, then, the chief work of the gastric

juice. As peptones, the nutritive element, proteid, passes directly into the absorptive vessels located in the walls of the stomach.

The gastric fluid is acid in its reaction and rapidly coagulates milk, fine, soft curds being formed. Meat is disintegrated by the acid juices. The contents of the stomach are reduced to a semifluid mass which has a milky appearance and an acid odor. This milky fluid is called chyme.

Starchy foods and fats are not digested by the stomach. The process of changing food into chyme is termed chymification.

The following table, prepared by Roberts, shows the use of each of the digestive ferments or enzymes:

TABLE OF DIGESTIVE FERMENTS

Name.	*Function.*
1. Ptyalin or salivary diastase found in saliva.	1. Changes starch into dextrin and glueose.
2. Pepsin found in gastrie juices.	2. In acid fluids changes albuminoids into peptones.
3. Curdling ferment eontained in gastric juice.	3. Coagulates easein.
4. Trypsin found in panereatie juiee.	4. In alkaline solutions transforms proteids into peptones.
5. Curdling ferment found in panereatie juice.	5. Coagulates milk easein.
6. Pancreatie diastase found in pancreatie juice.	6. Changes starch into dextrin and glucose.
7. Emulsive ferment found in panereatie juiee.	7. Emulsifies fats
8. Bile poured into the duodenum.	8. Assists in emulsifying fats.
9. Invertin found in intestinal juice.	9. Converts eane-sugar into inverted sugar.
10. Curdling ferment found in intestinal juiee.	10. Coagulates casein.

Intestinal Digestion.—At the conclusion of gastric digestion, the stomach contents (then called chyme) are poured into the duodenum.

In the walls of the small intestine glands similar to

the glands of the stomach are situated. These glands secrete the intestinal fluid, which aids in the digestion of food.

The character of chyme varies according to the food taken, but in general it may be said to consist of water, saliva, inorganic salts, undigested proteids and starches, cane-sugar, peptones, liquefied fats, and the indigestible part of flesh foods, cereals, vegetables, etc. In the intestines the chyme becomes mingled with bile, pancreatic fluid, and the juices poured out by the various intestinal glands. Each of these has some part in finishing the work of digestion. The functions of the bile have been mentioned in a previous chapter. In brief, it may be said to prevent decomposition, emulsify fats, and stimulate peristalsis. The pancreatic fluid completes the digestion of fats. The intestinal fluids complete the digestion of proteids and sugars.

While in the small intestine the nutritive products are taken up into the blood and the undigested residue is carried by peristaltic action through the ileocecal valve into the large intestine.

The villi are numerous small finger-like projections on the inner wall of the small intestine, which greatly increase its power of absorption.

The ascending colon possesses some power of absorption, and the liquids remaining are gradually lessened, leaving a more or less solid mass to be expelled by the process of defecation

Summary of the Process of Digestion.—The digestion of starches is commenced in the mouth by the saliva, continued in the stomach by the swallowed saliva, and completed in the intestines by the intestinal fluids.

The digestion of proteids is commenced in the stomach by the gastric fluids and continued in the intestines by gastric fluid, which is carried with the food, the pancreatic and intestinal secretions.

The digestion of fats begins in the stomach by the fat cells being set free by gastric juices. Digestion is completed by the bile and pancreatic fluid in the intestines.

Mineral salts are dissolved by the various digestive fluids.

ABSORPTION

Absorption is defined as the process of taking up certain substances and conveying them to the blood.

Assimilation is the process which goes on in the tissues whereby they appropriate the nutritive material that is carried to them.

Fig. 63.—Diagram showing the course of the main trunks of the absorbent system: The lymphatics of lower extremities (D) meet the lacteal of the intestines (LAC) at the receptaculum chyli (R.C.), where the thoracic duct begins. The superficial vessels are shown in the diagram on the right arm and leg (S), and the deeper ones on the left arm (D). The glands are here and there shown in groups. The small right duct opens into the veins on the right side. The thoracic duct opens into the union of the great veins of the left side of the neck (T) (Yeo).

The small intestine is the part from which absorption chiefly takes place. Sugars and peptones are partially absorbed through the stomach walls, and the process of absorption is completed in the large intestine.

The process of absorption is accomplished in two ways: by means of the blood capillaries and the lymph-vessels or lymphatic system so called, because the vessels usually

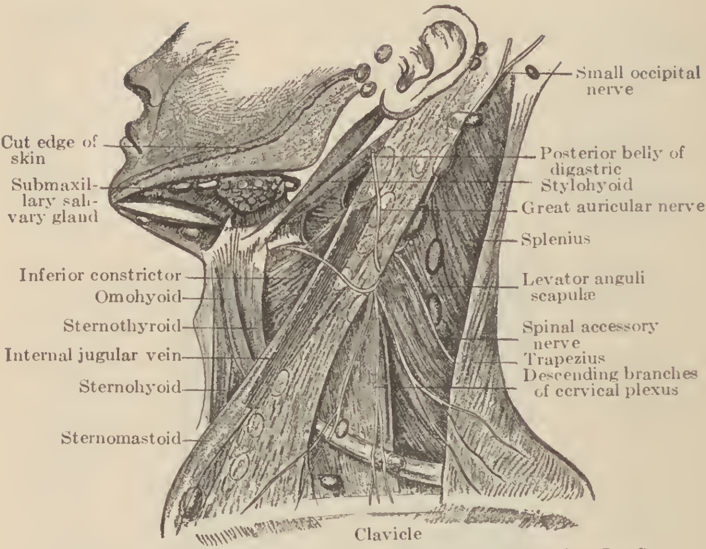


Fig. 64.—Lymphatic glands of the head and neck (after Leaf).

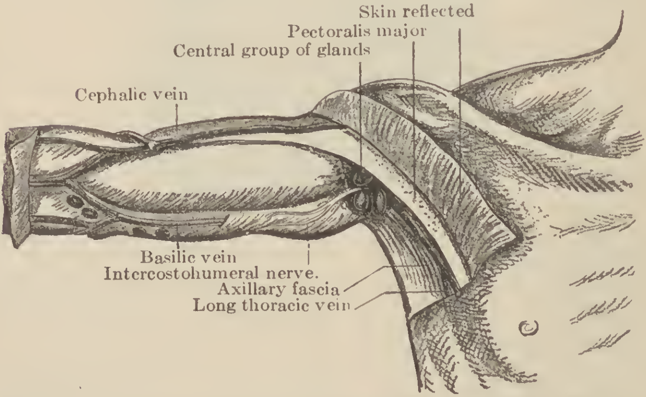


Fig. 65.—Central (superficial) lymphatic glands of the axilla (after Leaf).

contain a watery fluid. The lymphatic system is sometimes spoken of as the absorptive system because of the important work of absorption performed by it.

The *lymphatic system* consists of lymphatic capillaries, vessels, glands, and two large vessels known as lymphatic trunks. The lymphatic capillaries and vessels are intimately interwoven with the blood-vessels. The lymphatic vessels of the small intestine are known as lacteals. During digestion the lacteals contain a milky fluid called chyle.

The *thoracic duct* is the great general trunk of the lymphatic system. It lies just in front of the vertebral column. Into this the chyle is emptied. Its lower end is much enlarged and forms a receptacle for the chyle. Its upper end leads into a large vein where its contents join the blood-current.

In general it may be said that the chief office of the lymphatics is "to collect the fluid part of the blood which exudes through the walls of the blood-vessels, and substances, which though having once formed part of a tissue, are not yet waste material, but are capable of reorganization, and may, therefore, be adapted for nutrition" (Furneaux).

Metabolism is the term applied to the changes which take place in the tissue cells. These changes include both the building up and breaking down of tissue.

Anabolism is the term applied to the building up of tissue cells. In a general way it corresponds to nutrition.

Catabolism is the term applied to the breaking down or waste of tissue. The whole process of metabolism is being studied more than ever before, particularly as it relates to the undernourishment of school children.

CHAPTER VIII

THE URINARY SYSTEM

The urinary system consists of the kidneys, ureters, bladder, and urethra.

The **kidneys** are bean-shaped bodies situated on either side of the upper lumbar vertebræ. Each kidney is enveloped in a fibrous capsule and embedded in a mass of fat behind the peritoneum.

In *structure* the kidney is a mass of minute, winding tubes, known as uriniferous tubules, which are distributed irregularly. The cells which line this system of tubes separate the urea and other waste products from the blood. Several tubes unite finally in one collecting tube, which conveys the waste to the branches of the ureter.

The **ureters** are slender ducts leading from the kidneys to the bladder. The upper end of the ureter widens and opens into a cavity which is called the pelvis of the kidney.

The **bladder** is the reservoir for the urine. When empty it lies almost entirely in the pelvis.

The **urethra** is a canal lined with mucous membrane by which the bladder is emptied of its contents. A circular constricting muscle, known as the sphincter muscle, surrounds the neck of the bladder and prevents the involuntary passage of urine. At intervals this muscle relaxes and the muscles of the bladder contract to effect the discharge of the bladder contents.

In the female the urethra is about $1\frac{1}{2}$ inches long and curves slightly downward. The outer opening is termed the meatus urinarius.

The **kidneys** are both secretory and excretory organs. They secrete the urine by separating from the blood certain waste products, and are often termed (with the skin) the filters of the body. The amount of urine secreted daily varies, and is influenced by numerous

causes. Some physiologists claim that as much moisture is lost from the body through the skin as through the kidneys, and the action of the skin greatly influences the quantity of urine secreted.

In a healthy adult the amount of urine discharged from the body in twenty-four hours is estimated at about $2\frac{1}{2}$ pints or from 40 to 50 fluidounces.

Normal urine is a pale yellow or amber fluid, slightly acid. The degree of acidity varies. That voided in the morning is more strongly acid; that voided after eating or during digestion, especially if the food is largely vegetable in character, may be either neutral or alkaline.

Composition of Urine.—The chief ingredient in urine is water, which holds the solid matter in solution.

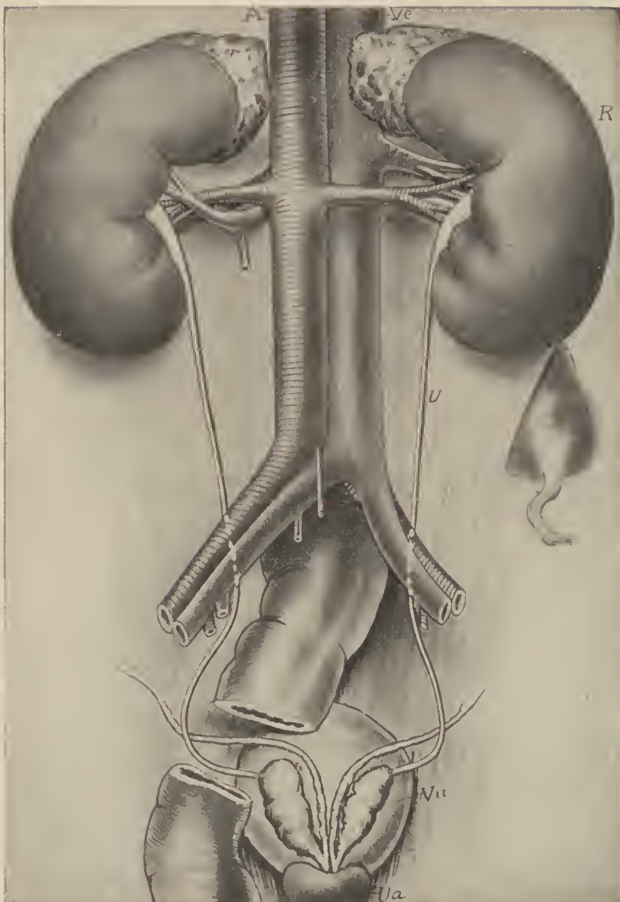
Urea is the next most abundant constituent. It is estimated that about 500 grains of urea are excreted daily.

Uric acid and a large number of other chemical mineral ingredients form the solid part of urine. The water exists in the proportion of 960 to 40 parts of solid matter.

Urea and *uric acid* are substances formed from the breaking down of albuminous compounds in the body. The quantity of these ingredients will necessarily vary in proportion to the amount of nitrogenous food eaten. A strictly vegetable diet is said to reduce the amount of these ingredients in the urine about one-half. Rapid waste of muscular tissue, which takes place in fevers and certain other diseases, will also greatly influence the quantity of these solids.

The amount of uric acid eliminated each day is estimated at from 5 to 10 grains. If an excessive amount is eliminated, it is deposited as a brick-dust sediment in the urine shortly after voiding.

The **color** may vary considerably in health. The transparency may be lessened by the presence of mucus and larger quantities of solid ingredients. It will also vary more or less according to the food taken. When



The kidneys, bladder, and their vessels viewed from behind (Campbell): *R*, Right kidney; *U*, ureter; *A*, aorta; *Ar*, right renal artery; *Ve*, vena cava inferior; *Vr*, right renal vein; *Vu*, bladder; *Va*, commencement of urethra.

the quantity of urine voided is excessive, it will usually have less coloring-matter. In highly nervous or hysteric conditions, the urine is usually very pale and copious in quantity. The same condition is present during convalescence after acute disease. During fever the urine contains, as a rule, more solid matter.

Other conditions which may cause variation from the normal standard are the presence of blood, pus, bile, or bacteria; the action of certain drugs, notably turpentine, which changes the odor; carbolic acid or iodoform, when absorbed in excessive quantities, which cause a dark, smoky appearance; rhubarb or senna, which change it to a bright yellow; salol and guaiacol in large doses, copaiba and santal oil, all produce characteristic changes.

Specific Gravity.—By this is meant the weight of a substance as compared with an equal volume of another substance taken as a standard. The specific gravity of normal urine is between 1015 amd 1030, the average being 1020; that of water, 1000.

Reaction is the mutual or reciprocal action of chemical substances upon each other. Normal urine has an acid reaction owing to the presence of certain acid mineral ingredients, but the degree of acidity varies.

Micturition is the act of voiding urine. The neck of the bladder is surrounded by a circular muscle (the sphincter), which contracts to prevent the constant passage of fluid from the bladder. When the bladder becomes full the walls contract, the sphincter relaxes, and allows the contents to be discharged through the urethra.

Retention, or the inability to void urine, occurs from various causes. The bladder may be temporarily paralyzed; the sphincter, owing to nervous disturbance, may refuse to relax; there may be an obstruction of the urethra; or there may be a dulling of the senses with no desire to expel urine.

Incontinence is the inability to retain the urine the normal length of time. It frequently occurs in children

and occasionally in adults, especially the aged. It may be due to weakness of the sphincter. In many cases of incontinence the bladder fails to completely empty itself, and may become dangerously and painfully distended, though the urine is discharged at frequent intervals.

Suppression, or absence of the urinary excretion, occurs when for any reason the kidneys fail to act. It is always a serious condition, which rapidly proves fatal if relief is not secured. The body becomes poisoned by the accumulation of its own waste products.

Oliguresis is scantiness of urine. It may occur from a variety of causes, of which the chief are taking a small quantity of fluid, excessive perspiration, diarrhea, which rapidly drains the fluids from the body through the bowels, high fevers, and inflammation of the kidneys.

Abnormal Constituents of Urine.—Of these, the two most frequently found are albumin and sugar.

Albumin in the urine indicates that "the kidney cells are not doing their work properly, since they are allowing part of the food to escape from the blood and be wasted in the urine. Albumin is not a waste substance, but an important food element, and, therefore, has no business in the urine." (Cuff.) The presence of albumin in the urine may be very temporary and does not always indicate serious disease. It is, however, always worthy of attention, and, whenever possible, the cause should be searched for and removed.

Sugar in the urine is less frequently found, but is always a serious condition.

Two tests for albumin which nurses should become familiar with are the heat test and the cold nitric acid test.

For the heat test fill a test-tube about one-third full of urine and heat it to boiling-point. If a cloudy precipitate appears in the urine, it is due to either earthy phosphates or albumin. If to the latter, the cloudiness will increase when a few drops of nitric acid are dropped from a pipet.

In using the cold nitric acid test, pour a small amount of nitric acid into a clean test-tube to the depth of ½ inch, slant the tube, and pour down very slowly a few drops of urine. A white ring will be seen where the urine meets the acid if albumin is present.

Sugar in the urine may be detected in various ways. Fehling's test and Trommer's test are common methods. These tests are best understood when taught by practical demonstration.

Casts in the urine "have much the same clinical meaning as albumin, although either may occur without the other. These bodies get their name from the fact that they are formed in the tubules as a mould. In certain abnormal conditions of the kidneys the renal tubules become at points filled with a substance which hardens, thus forming 'casts' of the tube. The casts are then washed out and can be found with a microscope in the urine."—Emerson.

Other abnormal constituents occasionally found in urine are red blood-corpuscles, pus-cells, epithelial cells, mucous, and bile pigment.

General Elimination.—The waste matter of the body consists mainly of old tissue cells, which are constantly breaking down in the body, and of food incapable of being digested or assimilated. A large amount of the waste of the body is carried off by the urinary system. The lungs, the skin, and the bowels are also actively engaged in the work of elimination.

In order to prevent clogging of any of the machinery of the body by retention of dangerous waste products, plenty of water must be supplied daily. The neglect to supply the body with sufficient water to carry on this natural cleansing is a common cause of disease.

The amount of waste of body tissue varies in proportion to exercise, occupation, external surroundings, etc., and is much increased in some forms of illness, notably fevers, in which the tissues are rapidly consumed by the

excessive heat of the body. The amount of nervous energy expended in an occupation is also a powerful factor in the process of waste.

CHAPTER IX

THE SKIN

The skin forms a protective covering for the body. Its chief functions are:

To afford protection to the deeper tissues.

To assist in the elimination of waste products.

To assist in regulating the heat of the body.

It is the chief seat of the sense of touch.

It consists of two layers: the epidermis, cuticle, or scarf skin, and the dermis, or true skin.

The **epidermis** is the outer layer and differs in thickness in the different parts of the body. It is composed on the surface of flattened cells or scales, which are hard, horny, and dry. These epithelial scales are constantly wearing away, layer after layer falling from the surface of the body, as they are pushed up from below by the incessant growth of new cells. These dead epithelial scales form one of the common constituents of dust. The pigment granules or coloring-matter, which give the skin its varying tints, are located in the lower layer of the outer skin.

Healthy skin has always a more or less pinkish tinge, due to the presence of blood in the capillaries of the true skin. It is more or less firm, smooth, and clear. The amount of pigment in the cells of the pigment layer determines whether the skin is dark or fair. The epidermis has no blood-vessels, contains few nerves, and is impermeable to moisture. When the skin is perfect, poisons of various kinds may be handled without injury,

but a wound as small as a pin prick may afford an entrance for such poisons into the blood.

The **dermis,** or true skin, is composed mainly of connective and elastic tissues and has many blood-vessels and nerves. Underneath this is the subcutaneous tissue, into the construction of which fat enters largely.

"The *use of subcutaneous tissue* is to fill up all the irregularities of surface in the underlying parts, and to give the rounded form and plumpness to the surface of the body. The fatty tissue also, being a bad conductor of heat,

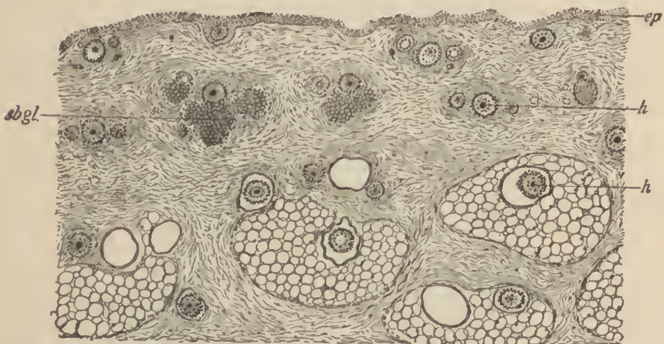


Fig. 66.—Transverse section of skin from scalp, showing hairs cut transversely: *ep*, Epidermis; *h*, hairs; *sbgl*, sebaceous glands (Fox).

serves to keep the body warm by preventing the outward passage of heat.

"The *sensibility of the skin* as the organ of touch is due to the distribution of nerve-fibers, which terminate in the papillæ of the dermis." (Furneaux.)

The skin is an organ both of secretion and excretion.

A secretion is a substance prepared for further use in the body.

An excretion is a substance that is separated from the tissues because it is useless or dangerous to the body.

Secretion and excretion are performed chiefly by glands, located in all parts of the body, and varying in

shape and structure according to their particular function.

Mucous membrane lines the alimentary tract, the respiratory tract, and the genito-urinary tracts. It is continuous with the skin, redder in color, more sensitive, and is kept constantly moist by a sticky fluid, known as mucus, which is secreted by small glands in the membrane.

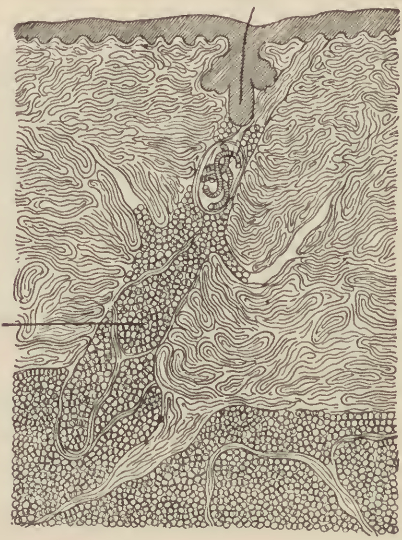


FIG. 67.—Vertical microscopic section through the skin (Fox).

Glands.—The skin has two sets of glands: the sebaceous and the sudoriferous.

The *sebaceous glands* are located in the true skin and connect with the hair that appears on the surface of the skin. These secrete an oily substance (the sebum), by which the skin and hair are lubricated and softened.

The *sudoriferous* or *sudoriparous* or *sweat-glands* excrete the sweat. Their function is to separate from the blood

the elements that go to form perspiration. These are called the pores of the skin, the ducts reaching down to the subcutaneous tissue and opening all over the surface of the skin. The sweat-glands are governed by the nervous system. A cold sweat may be caused by fear. Other influences that modify the action of these glands are mental emotions, rise of temperature in the body or atmosphere, exercise, and certain drugs.

Perspiration is defined as a watery fluid containing a small amount of dissolved common salt with a certain amount of other salts. Urea is a constant ingredient. The amount of perspiration varies with the season, the quality and quantity of food and drink, exercise, etc.

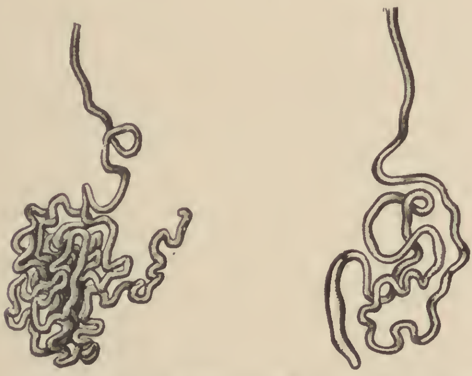


FIG. 68.—Sweat-glands of different size (of moderate magnification), showing coil or convolutions forming gland proper, the blind end of tubule, and excretory duct (Sappey).

It is continuously being eliminated, but usually passes off so gradually by evaporation that the individual is insensible to it. When, because of increased heat, or exercise, or other causes, the muscles of the skin relax, the gland ducts open wider, and a free copious perspiration results, this is termed sensible perspiration.

When the pores of the skin become clogged so that the perspiration cannot escape freely, the poisonous elements are reabsorbed into the blood, and extra labor is thrown

on other excretory organs, especially on the kidneys. As a result the kidneys may become diseased from overwork in dealing with the excess of waste products.

The chief use of perspiration is said to be the equalization of the temperature of the body or the protection of it from too great heat.

Perspiration is increased by:

1. Increased temperature of the air, water, or other heated substances with which the skin comes in contact.

2. Copious drinking of warm water or watery substances, especially if the fluid is hot.

3. By rise of blood pressure with increased heart action.

4. Increased temperature of the blood.

5. Muscular exercise.

6. Friction.

7. Diaphoretic drugs.

8. Electricity, which acts as a stimulant to the nerves controlling the secretion of sweat.

9. Mental excitement.

10. Certain diseases, such as malaria, rheumatism, etc.

"When the surrounding air is much warmer than the body, the vessels of the skin dilate, free perspiration takes place, and by its evaporation the body becomes cooled. If the air is already full of moisture, evaporation of the perspiration becomes more difficult, and we suffer more from heat than if the air were dry."

Perspiration is decreased by:

1. Cold.

2. Copious discharges of fluid from the bowels or kidneys.

3. Drugs, such as atropin.

4. Certain diseases, such as chronic dyspepsia, cancer, diabetes, etc.

Physiologic Effects of Temperature.—As the nurse is continually called on to make applications of water and administer treatment through the skin, the following brief statement of the general principles which determine

the effect of hot, cold, and neutral applications may be useful, until fuller instruction in hydrotherapeutic procedures can be obtained.

Hot Applications.—The primary effect of heat is stimulating. The blood-vessels are dilated. The secondary effect, or the reaction, is depressant and sedative. The effects produced by an application of heat are influenced by the condition of the patient, the intensity and length of the application, the form of application, and other causes.

Cold Applications.—Cold contracts the blood-vessels when first applied. It acts primarily as an excitant, then as a sedative. The secondary effect or reaction is invigorating and tonic. The effects produced depend on the method of application, the temperature, the condition of the patient, susceptibility, etc.

Neutral Applications.—A neutral bath (one at a temperature of from 92° to 95° F.) slightly stimulates the skin and kidneys, and acts as a general sedative. Mixed effects are produced by intermediate temperatures, and all effects are modified by the use of mechanical methods, such as friction, percussion, etc., or by exercise before or after the application.

Temperatures.—	Cold....................	33° to 60° F.
	Cool....................	60° to 70° F.
	Temperate.............	70° to 85° F.
	Tepid..................	80° to 92° F.
	Warm..................	92° to 98° F.
	Hot....................	98° to 112° F.

Appendages of the Skin.—The hair, sebaceous and sudoriferous glands, and the nails are spoken of as appendages of the skin.

Hair is found in almost all portions of the surface of the body. The color is due to the pigment matter.

It assists in protecting the head from heat and cold.

It prevents the entrance of foreign matter into the lungs, nose, ears, etc.

It assists in retaining the heat of the body.

Each hair consists of a root and a shaft.

The root is embedded in a point of skin called the follicle.

Nails are thick layers of the horny scales of the epidermis, their roots projecting deeply into the folds of the

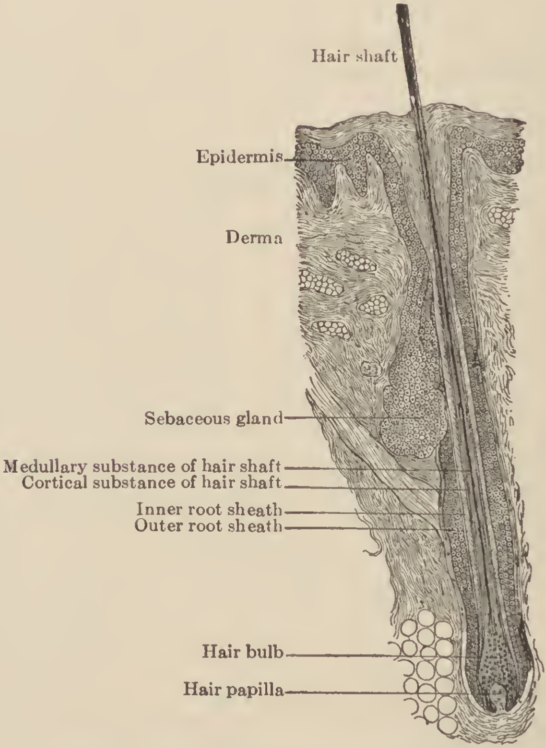


FIG. 69.—Section through hair and follicle (Fox).

skin. The matrix or bed of the nail is a modification of the true skin.

Nails are for the protection of the parts and to give strength when using the digits.

GLANDS

Glands are organs which secrete substances needed in the body. They separate certain materials from the blood and manufacture new substances. The glands of the body differ in many ways. A simple gland may be a small depression on the surface of a membrane or a gland may extend in a complicated system, opening by small ducts into the main duct, which carries the secretion to the surface for which it is prepared.

Secreting glands are divided into three classes: Simple, compound, and ductless.

Three essentials are characteristic of all glands. Each has a liberal blood-supply from which the material for the secretion is drawn; epithelial cells are the active secreting agents; they are directly controlled by the nervous system.

Secretion is the term applied to the substance produced by the gland which is provided for use in maintaining bodily functions.

External secretions are those which are carried away from the glands through ducts. Examples of external secretions are saliva, gastric fluid, pancreatic juice, bile, and intestinal fluid.

Internal secretions are discharged into the blood or lymph without being carried off by a duct. It has been shown that some of the glands carry on their function both by means of ducts and without ducts. The pancreas besides secreting the pancreatic fluid which is discharged into the intestinal tract, also forms an internal secretion which is absorbed directly into the blood.

The *ductless glands*, also called endocrine glands, have within recent years been made the subject of extensive research which has greatly influenced medical treatment. A new science, known as organotherapy or hormone-therapy, has been opened up which has produced remarkable results in a number of chronic diseases which had hitherto been regarded as almost hopeless.

The *ductless glands* include the spleen, pituitary, adrenals, thyroid, thymus, and gonads or "sex glands." "The

secretions from these glands and their extracts contain the hormones or chemical messengers of the organ, which excite some of the most marvellous reactions known in physiology."

Some abnormal condition of the adrenal or other endocrine gland is believed to be the foundation of much of the nervous trouble which affects women. It is well known that the sympathetic nervous system has an intimate reciprocal relation with the ductless glands.

The *adrenals*, or suprarenal glands, located on the top of the kidneys, are now known to perform several important functions, among which is the influence they exert on the regulation of the blood-supply and in maintaining the normal tone. Too much or not enough activity in the adrenal glands may result in uncontrollable nervousness, breathlessness on slight exertion, slow digestion, and obstinate constipation, with profound physical or mental depression. Chronic poisoning from the intestines or diseased teeth or gums are frequent causes of adrenal disturbance.

The *thyroid secretion* has a profound influence on the power of the body to resist disease because of its power to convert toxic substances into relatively harmless material. It exercises a most important influence on metabolism, on both physical and mental growth, and on the complex processes by which body waste is disposed of.

Thyroid deficiency is now recognized as complicating a great many of the disorders of childhood besides the more serious diseases, such as goiter, cretinism, etc.

The thyroid gland is located near the trachea.

The *spleen* is believed to exercise "a peculiar influence in stimulating digestion and in maintaining the mineral elements of the body in their proper solution."

The *pituitary gland*, situated at the base of the brain, exercises a powerful effect in promoting contraction of muscular tissue. Pituitary extract is much used in promoting uterine contractions in childbirth.

Other important glands are the parotid and the sub-

maxillary, which secrete saliva; the axillary, situated in the axilla; the lacrimal, which secretes tears; the sudoriferous glands, which secrete sweat; the mammary glands or the breasts; and the liver, which secretes bile.

Secretions.—*Saliva* moistens food and begins digestion of starches.

Bile assists in digestion.

Sweat helps to regulate body temperature and eliminate waste products.

Mucus acts as a diluent and lubricant.

Tears moisten the eyeballs and eyelids.

Gastric fluid begins the digestion of proteins.

Pancreatic fluid aids in digestive process.

Milk is nature's provision for food for infants.

Serum lubricates surfaces.

Vaginal secretion moistens, protects, and lubricates.

Urine eliminates waste matter; is first a secretion and later an excretion.

CHAPTER X

THE NERVOUS SYSTEM

THE nervous system is often spoken of as the ruler of the body. "Its first great work is to cause all the parts of the body to work harmoniously together. Its second is to act as the organ of the mind."

"The brain and spinal cord are often compared to a telegrapher in an office, and the nerves in the body to telegraph-wires that run out in all directions from the office. Over the wires the telegrapher receives messages that tell him what is going on about him, and he sends out messages commanding that certain things be done."

For general purposes it is convenient to divide the nervous system into two main divisions: the cerebrospinal system and the sympathetic or ganglionic system.

The **cerebrospinal system** consists of the brain and its nerves, and the spinal cord and its nerves.

The **sympathetic** or **ganglionic system** consists of double chains of ganglia or knots of nerve matter situated on either side of the vertebral column, extending from the skull to the pelvis. Numerous disconnected ganglia distribute nerve-fibers to the internal organs and the walls of blood-vessels, supplying them with nerve influence. In the abdomen just back of the stomach is situated a large group of these nerves, known as the solar plexus. Other important plexuses or groups are the cardiac and pulmonary in the thorax and the hypogastric in the pelvis.

Nerve tissue is of two kinds: cellular and fibrous tissue. Cellular nerve substance is found in the brain, the spinal cord, and all the nerve centers, and is grayish in color. It consists of cells which branch out and are interlaced with fibers. Fibrous nerve substance is composed of gray and white fibers, the gray being found chiefly in the sympathetic or ganglionic system, and the white forming an important part of the structure of the brain and spinal cord.

A *nerve* is a whitish cord which conveys impulses or messages to all parts of the body.

A *neurone* is a nerve cell.

A *nerve center* has the power to generate, receive, and transmit an impulse.

A nerve can only conduct the impulse generated in the center. The two have been likened to an electric

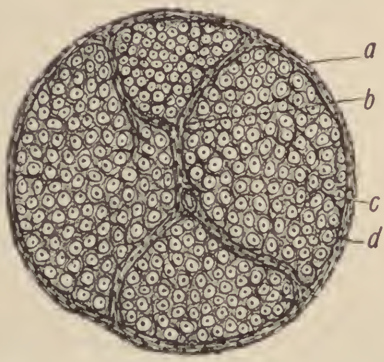


FIG. 70.—Transverse section of a nerve: *a*, Epineurium; *b*, perineurium; *c*, endoneurium; *d*, section of a single fiber (Leroy).

battery, and the wires by which the electric current is conveyed. The nerve center is the battery which produces the current; the nerves, the wires that conduct it.

Motor nerves are those whose office is to produce motion.

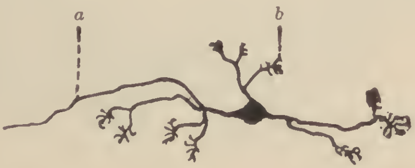


FIG. 71.—Nerve-cell with dendrites ending in claw-like telodendria: *a*, Neuraxis; *b*, telodendrion (Böhm and Davidoff).

Sensory nerves are those by means of which we feel pain, hunger, or experience any other sensation.

Vasomotor nerves convey impulses to blood-vessels and cause them to dilate or contract.

Mixed nerves contain both motor and sensory fibers,

and convey impulses in both directions by using different fibers.

The *nerves of the special senses* are called afferent or sensory nerves.

Afferent or *sensory nerves* conduct impressions to a nerve center only.

Efferent or *motor nerves* conduct impressions from a center only.

The **brain** is the great center from which issues the nerve force which vitalizes and controls the whole human system. The nerves are the servants which execute its commands and convey to it information concerning the outer world. The brain consists chiefly of soft nerve substance. The average weight of a man's brain is

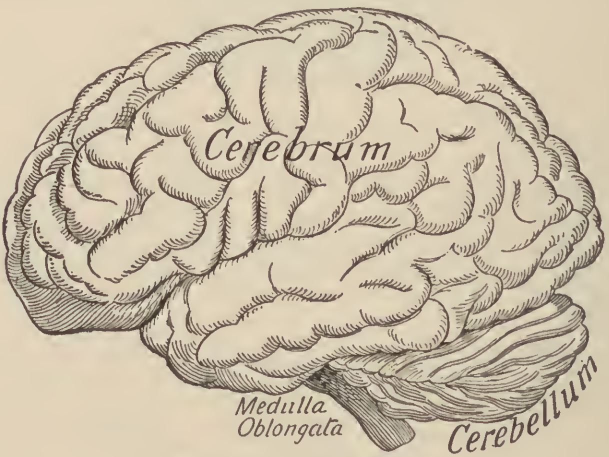


FIG. 72.—The brain (Morrow).

about 49 ounces, that of a woman, about 44, but a heavy brain is by no means a sign of special intelligence, for it is a well-known fact that criminals and persons of very meager intelligence have had unusually heavy brains.

The *pia mater* is a thin membrane which surrounds the brain. It is really a network of arteries and veins interlaced by connective tissue. From these vessels it receives

its blood supply. Outside the pia mater lies the arachnoid membrane, and between that and the skull is a tough fibrous membrane termed the dura mater. These three membranes, when spoken of collectively, are called the meninges. They enclose the spinal cord and divide the brain into a smaller and a larger portion.

The *cerebrum,* or greater brain, occupies the upper and frontal portion of the skull. It is the seat of intelligence, of sensation, and emotion, the organ of the will and voluntary motion.

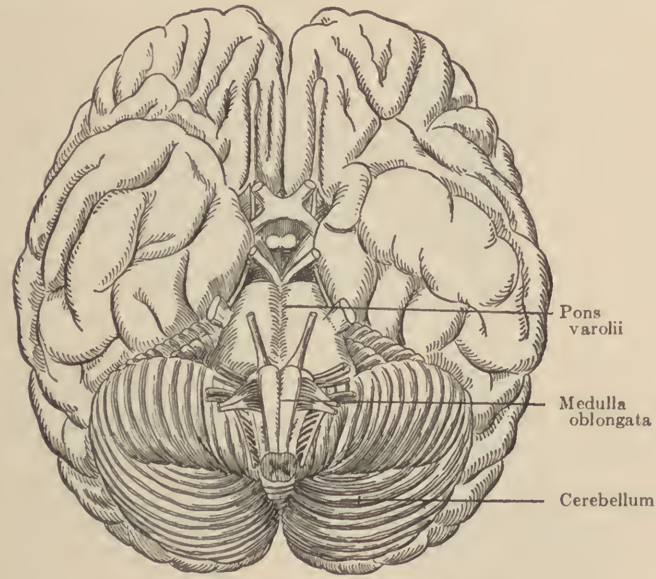


Fig. 73.—Base of the brain (Morrow).

The *cerebellum,* or lesser brain, is found beneath the back part of the cerebrum. It is the seat of muscular sense, by which we learn the condition of the muscles, and coördinate muscular movements.

The *medulla oblongata* acts as a connecting medium between the brain and spinal cord, and controls the involuntary motions of breathing and swallowing. With-

out it life cannot be maintained, as breathing instantly ceases when it is removed or destroyed.

The *pons varolii* is a bridge of nerve substance connecting the two divisions of the cerebellum and passing around the medulla.

The *cranial nerves* issue forth from the under surface of the brain. Of these, there are twelve pairs. These nerves produce the sense of smell, of sight, hearing, and taste, move the eyeball, and control the muscles of the eyes and face. The cranial nerves are numbered from

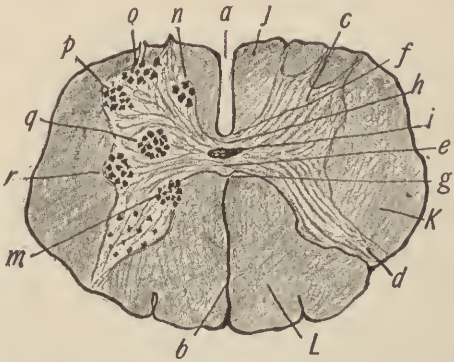


Fig. 74.—Lumbar section of spinal cord, showing main tracts of white substance and location of principal groups of nerve-cells in gray matter: *a*, Anterior median fissure; *b*, posterior median fissure; *c*, anterior horn of gray matter; *d*, posterior horn of gray matter; *e*, central canal; *f*, anterior white commissure; *g*, posterior white commissure; *h*, *i*, anterior and posterior gray commissures; *j*, anterior median column; *K*, lateral column; *L*, posterior column; *m*, column of Clarke; *n*, inner group of nerve-cells; *o*, anterior group; *p*, anterolateral group; *q*, posterolateral group; *r*, lateral horn (Leroy).

before, backward. The tenth pair, the pneumogastric nerves, are important mixed nerves, which send fibers to the liver, stomach, heart, lungs, and larynx. The fifth pair, the trigeminal nerves, are large nerves which send fibers to the skin of the face, the muscles of the lower jaw, and tongue.

The *olfactory nerves* are the nerves of smell, the optic nerves those of sight, and the auditory nerves supply the ear.

The **spinal cord** extends in the spinal canal from the medulla oblongata to the first lumbar vertebra. The three coats of the brain extend down and enclose it. Between the arachnoid membrane and pia mater there is a fluid known as the cerebrospinal fluid, which serves as a protection to the brain and spinal cord. The discharge of this fluid from the ear is a most important symptom where injury to the skull is feared. Between the dura mater and the vertebra is a protective covering of fatty tissue, which prevents injury to the spinal cord when the back is bent.

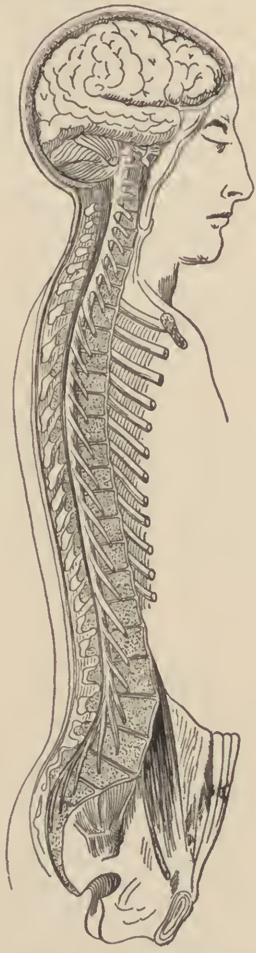


Fig. 75.—General view of the cerebrospinal nervous system (after Bourgery; Schwalbe).

The *spinal cord* is a means by which motor and sensory impressions are conveyed to and from the brain. It is also a center of reflex action.

Spinal Nerves. — Thirty-one pairs of nerves are thrown out from the spinal cord. At the lower extremity of the cord they are crowded into a bunch, called the cauda equina. The sensory nerve-fibers cross as they enter the cord. The motor nerves cross as they enter the medulla.

"The nerves of the cerebrospinal system are the nerves of conscious life, and are distributed to all voluntary muscles and to all sensitive structures, such as the skin, mucous membranes, lining of joints, and periosteum" (Bundy).

A *reflex action* is first an irritation of the sensory nerves which is communicated to the medulla and reflected along motor fibers to the termination of these fibers in muscles. This results in muscular contraction, which may be voluntary or involuntary. "Hundreds of reflex actions are going on continually in our bodies without our knowledge, and among them we include the so-called vital functions of the important organs, the cessation of which would cause instant death. Thus the action of the respiratory muscles is the ultimate result of a reflex action" (Furneaux).

The sight of tempting food will often cause the salivary glands to increase the quantity of saliva, and may also stimulate the gastric glands to greater activity through reflex action.

SENSATIONS

Sensations are the result of three causes or conditions. There must be some disturbing condition or irritation of one or more of the fibers of the sensory nerves. This irritation or pressure must be carried along the sensory fibers to the brain, the great nerve-center. In the brain this irritation is translated into a condition of consciousness.

Common or General Sensations.—General sensation is not localized, but is produced by means of nerves distributed over a wide area. Among these common sensations are heat, cold, pain, hunger, and fatigue.

Pain may be distinctly localized, but there is always a condition of general discomfort accompanying it, and the same is true of hunger.

Muscular sense is one of the general sensations which makes us aware of the condition of the muscles, and enables us to regulate the contractions of the voluntary muscles.

Objective sensations are irritations produced by outside objects.

Subjective sensations are within the body and are caused by a disturbance of the cerebrum.

SLEEP

Sleep is defined by Brubaker as "a periodic condition of the nervous system in which there is a partial or complete cessation of the activities of the higher nerve-centers. The cause of sleep is a diminution in the quantity of blood occasioned by a contraction of the smaller arteries under the influence of the vasomotor nerves. During the waking state the brain undergoes a physiologic waste as a result of the exercise of its functions; after a certain length of time its activities become enfeebled and a period of repose ensues, during which a regeneration of its substance takes place.

"When the brain becomes enfeebled there is a diminution of activity and an accumulation of waste products. Under these circumstances it ceases to dominate the medulla oblongta and the spinal cord. These centers then act more vigorously and diminish the caliber of the cerebral blood-vessels through the action of the vasomotor nerves, producing a condition of physiologic anemia and sleep. During this state waste products are removed, force is stored up, nutrition is restored, and waking finally occurs."

CHAPTER XI

THE ORGANS OF SPECIAL SENSE

The special sensations are sight, hearing, touch, smell, and taste.

The **eye** is the organ of vision. It consists of the eyeball, a round body composed of several layers or coatings, which, with its nerves, blood-vessels, muscles, and other tissues, fill its bony chamber, the orbit or eye-socket. It is protected from injury by the bones forming the socket, the eyelids and lashes, and is kept moist and clean by the lacrimal fluid, a salty fluid secreted by the lacrimal glands.

The *eyeball* is loosely held in place by a fibrous membrane attaching it to the walls of the cavity. It is moved by six muscles, which rotate it in various directions.

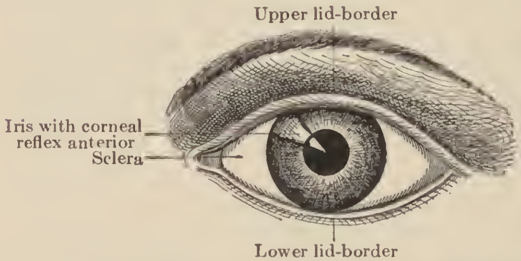


FIG. 76.—The anterior surface of the eyeball (Pyle).

When at rest these muscles, if normal and well balanced, hold the eye so that its pupil is directly in front. If the muscles are weak or of unequal strength the eye will be turned inward or outward, constituting the condition known as strabismus or "cross-eye."

These *muscles* are attached to the ball of the eye, and at the back to the eye-socket walls. They are known as internal and external rectus, superior and inferior rectus, and superior and inferior oblique. In certain diseases and in some forms of poisoning some of the muscles may be paralyzed or weakened, so that they lose their power of co-ordination. In such cases there is double vision.

The eyeball is made up of three distinct coats or layers. The outer layer consists of the cornea and the sclerotic

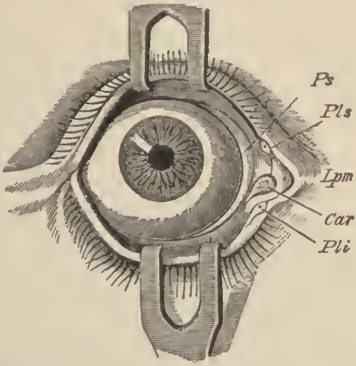


FIG. 77.—Right eye from before, the eyelids separated by hooks: *Ps*, Plica semilunaris; *Pls*, *Pli*, superior and inferior lacrimal puncta; *Car*, lacrimal caruncle; *Lpm*, internal tarsal ligament.

coat or sclera, the "white of the eye." The sclera gives form to the eye and protects the delicate structures

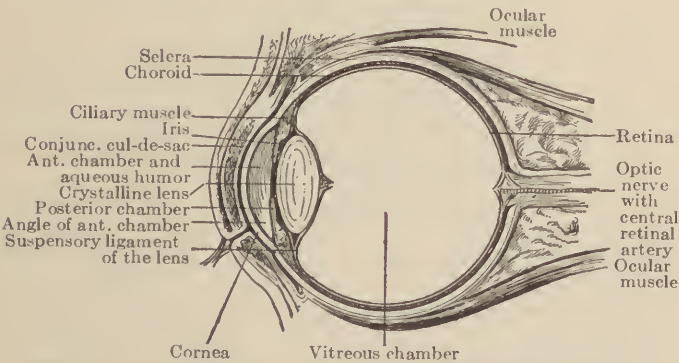


FIG. 78.—Vertical section through the eyeball and eyelids (Pyle).

within. The cornea is a transparent membrane covering the front of the eyeball for about one-sixth of its surface. The cornea has no blood-vessels.

The choroid and iris constitute the second or middle coat of the eyeball. The choroid is the dark brown membrane lying within and close against the sclera. It has a network of blood-vessels. The tissues through which the blood-vessels pass contain numerous pigment cells which provide coloring-matter. The choroid coat does not extend over the center of the front of the eyeball.

The *choroid coat* is concerned largely with the nutrition of the eye. Another use is to darken the chamber of the eye.

The ciliary processes are formed by a folding inward of the choroid. They are the fringe-like processes that encircle the margin of the eye-lens.

The *iris* is a circular membrane directly back of the cornea. It also contains blood-vessels and the pigment matter which gives the color to the eye. Its center is a circular opening called the pupil. The muscular fibers composing the iris are capable of dilating or contracting, thereby changing the size of the pupil and regulating the amount of light admitted.

"The *ciliary muscle* surrounds the circumference of the iris. This muscle is the chief agent in 'accommodation.'" (Leonard.)

The *retina* is the inner coat of the eye. It is the screen on which the images fall, a most complex and delicate structure, which is essential to vision. From the retina the optic nerve passes out to the brain. The optic nerve conveys sensations of light, but not of pain.

The *optic nerve* is not a single nerve. Many nerves have their terminals in the retina, and are gathered into a bundle forming what is known as the optic nerve. One portion of the retina may be injured, as happens sometimes in case of a hemorrhage, and other portions may still receive the images.

Aqueous humor is a watery fluid found in the anterior chamber of the eye.

Vitreous humor is a transparent semisolid substance which helps to give form to the eyeball. It is covered on its outer surface by a thin membrane.

The *crystalline lens* is a solid body surrounded by a capsule kept in place by a ligament situated close behind the iris. It is convex in shape and transparent. Its function is to focus the rays of light with the formation of an image on the retina.

The *refracting apparatus* consists of the cornea, aqueous humor, crystalline lens, and vitreous humor. By means of these the rays of light are so manipulated that an image is produced on the retina.

FIG. 79.—The tongue: *A*, Papillæ (fungiform); *B*, papillæ (circumvallate); *C*, foramen cecum; *D*, lingua tonsillar tissue (Campbell).

Accommodation is defined as the power which the eye possesses of adjusting itself to vision at different distances.

The *eyelid* is a movable fold of skin in front of the eyeball. Its inner surface is lined with a mucous membrane called the conjunctiva.

The *conjunctiva* is exceedingly sensitive, and if a foreign substance lodges upon the membrane, it causes tears to flow in the effort to dislodge the foreign body.

The *lacrimal glands* are located in the outer corner of each upper eyelid. "These glands secrete the tears which are carried across the eye to the inner corner, where they enter the lacrimal duct. The workings of the lacrimal glands give us another illustration of the effect of the mind on the body, for sorrow, pain, and sometimes anger cause them to secrete so abundantly that the tears cannot all be carried away by the lacrimal ducts, but overflow on the cheeks."

The **sense of touch** is a modification of common or general sensation located in the skin. The thickness of the outer skin and the number of nerve terminations in a given area influence the sensitiveness of the skin. All parts of the body where there are sensory nerves are to some degree organs of touch, but in the skin, tongue, and lips this sense of touch or tactile sensibility is most acute.

The **sense of taste** is located chiefly in the tongue and the mucous membrane of the palate, the roof of the mouth. The impressions of taste are produced by the substance or food coming in contact with the nerve-endings of the mucous membrane. The flavor substance must be either in solution or capable of being dissolved in the saliva, so that it may be absorbed. The irritation of these sensory nerve-fibers by the substance is transmitted to the brain, producing the consciousness of taste.

The Nose.—The two sides of the nose open externally through the anterior nostrils, and at the back into the nasopharynx. The nasal bones form the upper and hard portion of the ridge of the nose. The lower portion is of cartilage and flexible.

The *turbinated bones* are adapted by shape and position to increase the surface of the air-chambers and to obstruct somewhat the air-current. On and around the superior

turbinated bone is the membrane which is the seat of smell. The mucous membrane which lines the nose is kept constantly moist with mucus which catches dust and germs in the air that is inhaled. The air which comes in contact with the moist mucous membrane becomes slightly moistened before entering the lungs. The mucous membrane contains large blood-vessels which warm the air. The sensitive nerves detect unpleasant or dangerous odors. The air in passing through the rather tortuous passage through the nose has been moistened, warmed, and to a considerable extent purified and rendered suitable to enter the lungs. The advantage

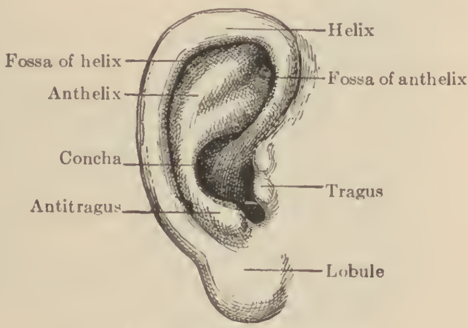


FIG. 80.—External ear (Randall)

of this is rarely appreciated till one sees patients whose nasal passages are obstructed, as in "mouth-breathers."

The **sense of smell** is dependent on the olfactory nerves which are located in the mucous membrane which lines the upper part of the nasal cavity. These nerves expand as they reach their termination in the mucous membrane into olfactory bulbs.

These olfactory bulbs are the centers in which impressions of odors are perceived as sensations. The sense of smell is lost once these bulbs are destroyed. In animals

which have a very keen sense of smell these bulbs are increased and highly developed.

Temporary loss of smell is often caused by the swollen condition of the mucous membrane due to a cold or other causes.

The **ear** is the organ of hearing. It consists of three parts: the external ear, the middle ear, or tympanum, or drum, and the internal ear, or labyrinth.

The *external ear* consists of the pinna or auricle and the external auditory canal. These are outside the

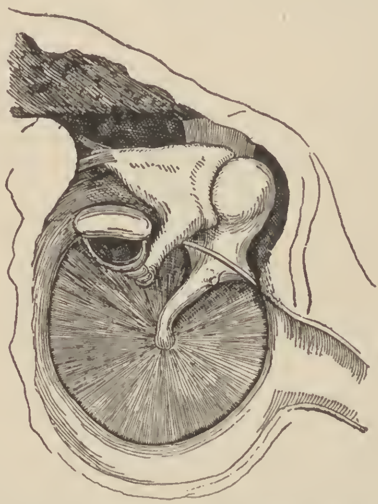


FIG. 81.—The drum-membrane and ossicles from within, showing attachment of malleus handle to drum-head, the insertion of the tensor tendon below the chorda, the axis of rotation through the gracilis process and the posterior ligament of the incus, and the tooth of its articulation with the malleus head (Randall).

skull. The auditory canal is about $1\frac{1}{4}$ inches in length. In the lining of the canal are glands which secrete cerumen or ear-wax. This, with small hairs found there, tends to protect the ear from dust, insects, etc.

The *middle ear*, or tympanum, or drum is a small cavity

hollowed out of the temporal bone. It is separated from the external auditory canal by a membrane called the tympanic membrane. In it is a chain of small bones which serve to transmit sounds, which are caused by vibration in the atmosphere, across the cavity to the inner ear.

The *Eustachian tube*, sometimes called the auditory tube, connects the cavity of the middle ear with the pharynx. It is partly bony and partly cartilaginous,

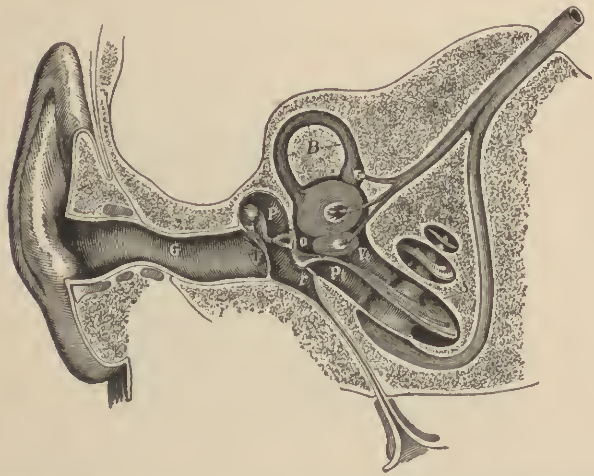


FIG. 82.—Semidiagrammatic section through the right ear: *G*, External auditory meatus; *T*, membrana tympani; *P*, tympanic cavity; *o*, fenestra ovalis; *r*, fenestra rotunda; *B*, semicircular canal; *S*, cochlea; *Vt*, scala vestibuli; *Pi*, scala tympani (Czermak).

and is lined by mucous membrane which is continued into the mastoid cells. It is an air-chamber or tube the function of which is to equalize the air pressure on both sides of the drum. Unequal pressure of air in the middle ear results in impairment of hearing.

An opening at the back of the middle ear communicates with the mastoid cavity of the skull, a point which is frequently the seat of serious inflammation.

The *internal ear* or labyrinth is exceedingly complex in structure. It consists of a bony and a membranous portion. The interior of the labyrinth contains a clear fluid (the perilymph), which is secreted by the periosteum lining the bony walls.

The auditory nerve conveys sensations of sound from the ear to the brain.

CHAPTER XII

NOTES ON SURGICAL ANATOMY

Scattered through the preceding chapters are numerous clinical applications of anatomy. The additional notes which follow on applied anatomy, particularly as it relates to surgical conditions, should aid in a better understanding of some common conditions encountered in the practice of nursing.

Scalp Wounds.—Almost every variety of wound may be observed on the scalp, and in these wounds there is a

Fig. 83.—Section showing layers of scalp and structures beneath: *A*, The skin; *B*, the superficial fascia; *C*, the occipitofrontalis; *D*, subaponeurotic layer; *E*, pericranium; *F*, bone; G, dura mater (Campbell).

tendency to persistent hemorrhage, which is often alarming out of proportion to the real danger, and often quite difficult to check.

Covering the vault of the skull are five layers—the skin, which is much thicker than in other parts of the body; the subcutaneous fatty tissue; the occipitofrontalis muscle and its aponeurosis; the subaponeurotic connective tissue and the pericranium.

The pericranium corresponds to the periosteum covering other bones, but differs somewhat in its functions.

The larger superficial blood-vessels of the scalp have their general course upward toward the crown of the head. It is, therefore, possible to arrange a bandage around the head in such a way as to arrest hemorrhage or even to cut off the blood-supply.

Mastoid cells, or the mastoid portion of the temporal bone, are often the seat of severe inflammation, developing frequently as a complication of middle-ear disease and in infectious diseases. In infants the mastoid process is not visible until the second year. "Most of the mastoid cells are air-spaces. The cells vary greatly in size and

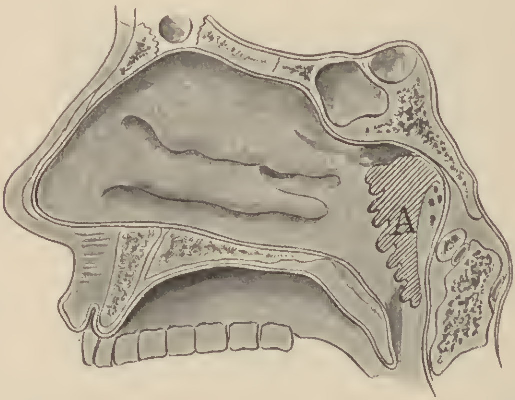


Fig. 84.—Diagram (anteroposterior) illustrating by the shaded portion (*A*) the situation of adenoid vegetations in the nasopharynx (Kerr).

extent in different individuals. The facial nerve passes close to this part and may readily be involved in mastoid disease. Mastoid inflammation may readily extend to the membranes of the brain and produce meningitis. It may extend farther and cause abscess in the neighboring part of the brain." (Treves.)

The *Eustachian tube*, extending from the nasopharynx to the tympanum or middle ear, may become closed, and impairment of hearing may result from thickening of the

mucous membrane of the tube. This frequently results from inflammation extending from the pharynx, from enlarged tonsils, and postnasal growths, in which the opening into the tube is mechanically obstructed. "The near relation of the pharyngeal end of the tube to the posterior nares serves to explain a case where suppuration in the mastoid cells followed the plugging of the nares for nosebleed." (Treves.)

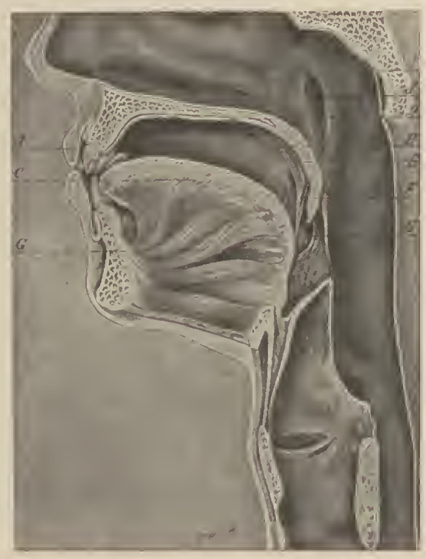


FIG. 85.—Vertical section of mouth and pharynx: *A*, Vestibule; *B*, cavity of mouth proper; *C*, tongue; *D*, hard palate; *E*, soft palate; *F*, uvula; *G*, geniohyoglossus muscle; *H*, tonsil; *I*, nasopharynx; *J*, orifice of Eustachian tube (after Deaver).

The Pharynx.—"The mucous membrane of the pharynx is very vascular and readily inflamed. * * * * Much adenoid tissue is distributed in the mucous membrane, a distinct collection of adenoid tissue stretching across the hinder wall of the pharynx between the openings of the Eustachian tubes. This deposit of adenoid tissue may undergo hypertrophic change, and the condition known as

'adenoid vegetations' or 'post-nasal growths' be produced. These growths may cause deafness and may block the posterior nares." (Treves.) Where adenoid growths are present, the child is starved for air and the mouth-breathing habit is developed.

Hypertrophy of the tonsils is commonly associated with adenoids, and tonsils and adenoid growths are often removed at the same time. The tonsil is very vascular, and the operation is often attended with severe hemorrhage.

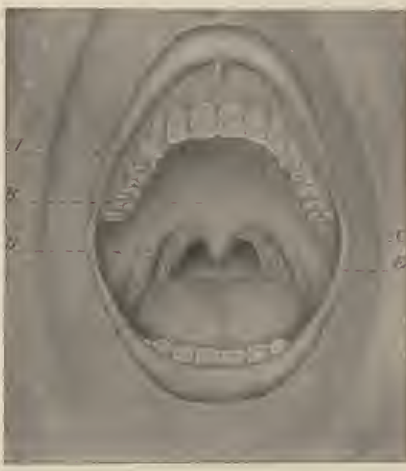


Fig. 86.—Surface markings shown within the mouth: *A*, Hard palate; *B*, soft palate; *C*, uvula; *D*, pillars of fauces; *E*, tonsils (Campbell).

Secondary hemorrhage, occurring several days after the operation, is not unusual.

The Axilla or Armpit.—The skin in this region is provided with many short hairs and with numerous sebaceous and sudoriferous glands, which, owing to friction or other causes, are often the starting-point for superficial abscesses. The connective tissue in this space is very loose, allowing free movement of the arm, but also permitting of large collections of pus or blood in this region. The great im-

portance of this space is due to the large vessels and nerves and the lymphatic glands located therein.

Lymphatic glands, or lymph-nodes, are small round or oval structures varying in size from a pin-head to a small bean, intersecting the lymphatic vessels at numerous points throughout the body. In the neck, axilla, groin,

FIG. 87.—Lymphatics of breast and axilla (Campbell).

beneath the knee, elbow, and in the abdomen, these glands are most numerous. Under certain conditions of disease in an organ or tissue these glands become enlarged, the disease extending along the course of the lymphatics until one gland after another becomes affected.

The **mammary glands** or breasts are made up of lobes, which are again subdivided into lobules, each of which has a tube or duct leading into a main canal which opens on the surface of the nipple. The tissue cells of the breast

are capable of secreting milk from materials found in the blood. "Each lobe of the breast may be likened to a bunch of grapes and the stem to the milk-ducts. Each breast has fifteen to twenty lobes, and the ducts leading from these lobes are all brought together in the nipple. Between the lobes or bunches, the irregular spaces are filled with fat and connective tissue. The gland rests on a bed of connective tissue, which separates it from the

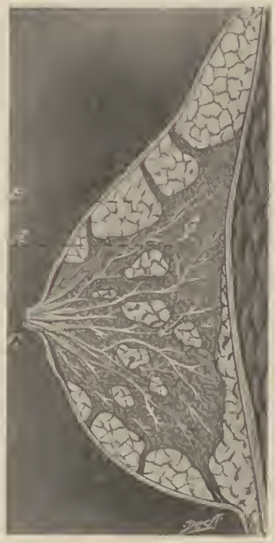


FIG. 88.—Sagittal section of breast: *A*, Gland substance; *B*, fatty tissue; *C*, lactiferous ducts (Campbell).

chest muscles, ribs, and intercostal spaces." (De Lee.) Mammary abscess is usually due to infection entering through a fissure or break in the skin of the nipple. The pus forms between the lobules of the gland. "Abscesses of the breast should be opened by incisions radiating from the nipple so as to avoid unnecessary damage to the mammary ducts.

"As the chief blood-supply of the breast comes from the

axilla, and as the main lymph-vessels proceed to that region, it follows that malignant growths of the gland tend to spread toward the axilla rather than toward the middle line." (Treves.)

Topographic Areas.—For convenience of description the trunk of the body is divided into areas or regions, such as the anterior thoracic region. The abdominal region and

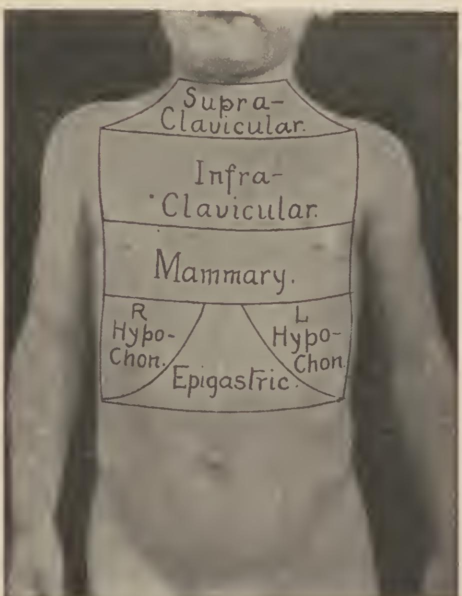


FIG. 89.—Topographic areas of the anterior thorax (Kerr).

the back is also divided into regions or areas to which definite terms are applied (Figs. 89, 90). The abdominal region is more frequently explored in surgery than the other regions.

The **abdomen** or abdominal region is divided by an imaginary line horizontal into three main portions—upper, middle, and lower, or the epigastric, umbilical, and hypogastric regions. Vertical lines, drawn as in diagram

shown in Fig. 89, give six additional sections to which special names have been given (Fig. 90).

The *abdominal wall* is composed of several layers—skin, superficial fascia, which in the lower part can be readily divided into two layers, adipose tissue, muscle. The relative thickness of the abdomen depends more largely on the subcutaneous fatty or adipose tissue than on the

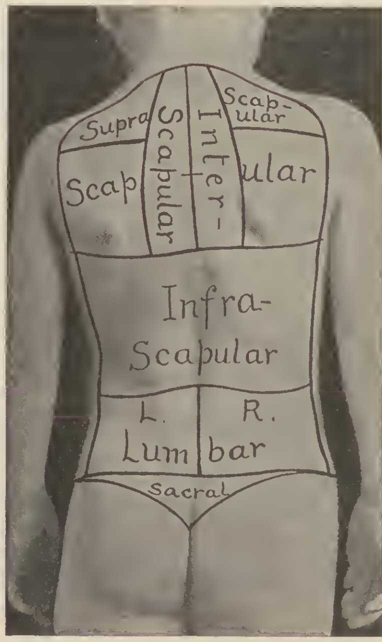


FIG. 90.—Showing the topographic areas of the back (Kerr).

thickness of the muscles. The muscular boundary serves as a protection to the viscera within. The abdominal muscles are capable of contracting to great rigidity.

The **linea alba,** a tendinous white line down the front of the abdomen, is the line most frequently chosen for incisions into the abdomen. "At this point the abdominal wall is thin and free from visible blood-vessels."

Ventral Hernia.—If the abdominal wall is to be as firm and elastic after operation as before, the several layers of tissue must be healed together securely as in the original arrangement. Occasionally this does not occur, and as the patient begins to stand and walk, pressure is brought to bear on the scar; the tissues gradually separate, leaving only one or two layers holding together. These are not sufficient to hold back the intestine and omentum, and a protrusion occurs formed by the layer covering the intestine and the omentum within. This is called ventral hernia.

FIG. 91.—The abdominal regions: The heavy line at the upper border shows the extreme limit of the diaphragm. Imaginary lines divide the abdomen into different regions which, for the sake of clearness and precision, are known as the right and left hypochondriac, the epigastric, the right and left lumbar, the umbilical, the right and left inguinal or iliac, the hypogastric (Kerr).

It is detected by observing a protrusion, with a gradual thinning or widening at some point in the abdominal scar.

The **umbilicus** or umbilical ring, the aperture in the abdominal wall by which the umbilical cord communicates with the fetus, is another surgical landmark of great importance. "Its location varies somewhat with the obesity of the individual and the laxity of the abdomen. * * * In the adult it is somewhat above the center of the body as measured from head to foot, while at birth it is

below that point. The fibrinous ring of the umbilicus is derived from the linea alba. To this ring the adjacent structures, skin, fascia, and peritoneum, are all closely adherent." (Treves.)

The **abdominal cavity** is enclosed by a wall formed by the abdominal muscles, vertebral column, and the ilium. The diaphragm is its roof.

The **peritoneum,** which lines the abdominal cavity, is a serous membrane which folds in and around all the organs of the pelvis. In the male the peritoneum is a closed sac. In the female the Fallopian tubes form openings into the peritoneal cavity on either side of the uterus. (See p. 79.) In the female, peritonitis, or inflammation

FIG. 92.—Transverse section showing arrangement of abdominal muscles: *A*, Rectus; *B*, external oblique; *C*, internal oblique; *D*, transversalis (Campbell).

of the peritoneum, may result from infection introduced through the vagina and advancing into the peritoneal cavity.

An **omentum** is a fold of peritoneum connected with the stomach.

"The **mesentery** is the fold of peritoneum which attaches the intestine to the posterior abdominal wall. It consists of the mesentery proper, a membrane connecting the small intestine with the spinal column, and the mesentery of the cecum, colon, and rectum, called respectively mesocecum, mesocolon, and mesorectum." (Dorland.)

Ischiorectal fossa is the name given to the space between the ischium and rectum. It is filled with loose con-

nective and adipose tissue, and is frequently the seat of infection resulting in abscess.

Poupart's ligament, also called the inguinal ligament, stretching from the spine of the ilium to the spine of the pubis, is an important landmark in surgery.

"The lowest portion of the peritoneal cavity is in the pelvis, extending down about $3\frac{1}{2}$ inches in front of the rectum. In the female this is called the recto-uterine fossa, or pouch or culdesac of Douglas. In the male it is the rectovesical fossa."

The **inguinal region** is frequently the seat of disease or disturbance requiring surgical interference. The term "inguinal" means pertaining to the groin.

The **abdominal inguinal ring** opens into the abdomen in the inguinal region, through the transversalis fascia. The subcutaneous inguinal ring opens through the external oblique muscle just above the pubic bone, being under the skin in the inguinal region. The inguinal canal is the passage connecting these two rings. The inguinal canal is smaller and narrower in the female than the male. The inguinal canal serves for passage of the spermatic cord with its vessels in the male, and the round ligament in the female.

Inguinal hernia consists of the passage of part of the intestine or omentum through the inguinal canal. "The herniated bowel is contained within a sac which is always formed of the peritoneum." (Treves.)

The **femoral ring** forms a weak place in the pelvic wall, under the inguinal ligament, where the femoral vessels do not occupy the whole of the space in their sheath. The femoral or crural canal extends downward from this ring, and is larger in women than in men. Femoral hernia is much more common in the female, and the tendency appears to be increased by the weakening effects of pregnancy on the abdominal walls.

The Bladder.—Many of the surgical procedures relating to nursing require that treatment be administered either through the bladder, the vagina, or the rectum. The bladder is situated in the cavity of the pelvis, behind the pubes, in the adult. In infancy it lies in the abdomen.

Behind it, in the male, is the rectum. In the female the bladder is in front of the uterus, resting partly on the cervix, and is held in place by powerful ligaments. It may become so distended that the summit will be at the umbilicus or above it. It has four coats. A peritoneal coat covers the upper surface and is carried back over the posterior portion; a muscular coat, a submucous coat and the mucous membrane which forms the interior lining. The mucous membrane of the bladder is very lax to allow of its accomodating itself to the varying changes in the size of the receptacle. Its average capacity in the adult is about one pint, but it is capable of great distention.

The neck or cervix of the bladder is the commencement of the urethra. In the male the prostate gland surrounds the neck of the bladder. Enlargement of this gland is a frequent cause of retention of urine, or inability to entirely empty the bladder. This condition occurs very frequently in the male after sixty years of age. Prostatic abscesses are not unusual.

In the female, owing to the comparative thinness of the walls that separate the vagina from the bladder and rectum, it happens occasionally that fistulous openings occur between the vagina and bladder and also between the vagina and rectum, thus allowing the urine sometimes to escape through the vagina, and sometimes the contents of the bowel to escape in the same manner.

The **rectum** is capable of great distention. In fecal accumulations it is possible for the distended rectum to push the adjacent organs out of their natural position. It is also possible by the relaxing of certain ligaments, or the giving way of some parts of the walls of the vagina, for the bladder or the rectum to protrude into the vagina, thus producing what is known as a cystocele, a protrusion of the front wall of the vagina with a lowering of the base of the bladder; or a rectocele, a protrusion of the back wall of the vagina and the front wall of the rectum. This condition is usually due to injury to the perineum, that takes away the posterior support of the vaginal wall.

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SECTION II

ELEMENTARY CHEMISTRY

CHAPTER XIII

INTRODUCTION

Chemistry is one of the important divisions of natural science. Two great departments of natural science are recognized: one, called natural history, includes geology and biology, which includes zoölogy and botany; the other, termed natural philosophy or physical science, includes mechanics, physics, and chemistry.

Chemistry treats of matter in its smallest subdivisions. It deals with all kinds of substances. It examines the atoms of matter and changes of properties which even vast quantities of matter undergo by reason of changes in kind, in number, and in relative position of the atoms, which, in obedience to chemical affinity, are gathered together in minute groups. In brief, chemistry is the science which treats of the composition of matter, properties of substances, and energy within the substance. All the various sciences overlap to some extent.

The Field of Chemistry.—In the study of chemistry we learn that every substance that we can see, feel, taste or smell, or in any way deal with by means of our senses, belongs in one or the other of two great classes—organic and inorganic substances. The former includes products having a definite structure produced by the forces of plant and animal life—milk, meat, wood, etc.—the latter dealing with minerals and the soil in which they are found.

In every-day life there are countless applications of the

principles of chemistry. It has to do with the various processes of cooking and heating; with the purity of food and water; with the changes which are constantly going on in the animal body and in the plant world which is all about us.

Included in chemistry are a great variety of problems which have to do with agriculture and various manufacturing processes. The manufacture of medicines, paints, dye-stuffs, soaps, etc., suggests one group of chemical problems; the preparation and uses of the various steel and mineral products another group; and the study of how fertility of soil may be increased or conserved leads off into still another great field, involving complex chemical processes.

Elementary substances are the simplest of all substances. They cannot by any known means be divided or changed into other substances. A compound results when different elements unite. For example, metallic iron is a chemical element or an elementary substance. Oxygen gas, always present in the air about us, is another. Iron when exposed to damp air soon becomes changed into a mass of iron rust. This rust is a compound made up of iron and oxygen united together.

There are about eighty elements, of which about twenty are necessary to maintain physical life. Twenty-five are commonly found in every-day life, but many of the elements are uncommon, occur in exceedingly small quantities, and only in special localities. Words ending in *ium*, as aluminium, calcium, etc., suggest that the substances so named belong to the metallic group.

The Construction of Substances.—For purposes of analysis all substances may be studied in mass, molecule, or by atoms. The mass is represented in substances as they appear in ordinary life. It represents the largest individual portion of a substance.

An atom is the smallest known portion of matter which retains its chemical properties. It cannot be further

divided. Every substance which we see or know has been built up from atoms.

The molecule consists of two or more atoms. The word means a little portion. It is the smallest part of a compound that can exist and maintain its chemical features. For example, a molecule of sugar contains three kinds of substance—carbon, hydrogen, and oxygen—each existing in the molecule in separate minute portions. The atoms of carbon, hydrogen, and oxygen differ distinctly from each other.

Chemical Affinity.—Each atom and each molecule is possessed of an invisible power of attracting to itself other atoms. It manifests strong likes and dislikes. So strong is this power that it is difficult to keep certain substances apart. This power is termed chemical affinity. For example, atoms of iron readily unite with those of oxygen, but absolutely refuse to unite with certain other substances. Each atom seems to possess its own special individuality and is always consistent in its likes and dislikes. One of the principal uses of chemistry is to study the relations of the elements and of compound substances toward each other. It represents a vast field for experiment, for the discovery of new facts, and for applying these discoveries in every-day life. The recent great war has markedly stimulated chemical research, and has resulted in chemical discoveries which have a far-reaching influence in the welfare of mankind and of world commerce and progress.

Atomic Symbols.—Each chemical element has an atomic symbol which is in most cases an abridgment of its name.

Atomic Weight.—A great variety of methods of weighing atoms have been used. While atoms are too small to be weighed separately, yet their relative weights have been determined and agreed upon by scientists. The atomic weight of oxygen is 16, and the weight of one atom of oxygen is taken as the unit of the system.

TABLE OF IMPORTANT ELEMENTARY SUBSTANCES

Name of element.	Symbol.	Atomic weight.	Valence.
Aluminium	Al	27	III
Antimony	Sb	120	III, V
Arsenic	As	75	III, V
Bismuth	Bi	208	III
Boron	B	11	III
Bromin	Br	80	I
Calcium	Ca	40	II
Carbon	C	12	IV
Chlorin	Cl	35.5	I
Copper	Cu	63.6	I, II
Gold	Au	197	I, III
Hydrogen	H	1	I
Iodin	I	127	I
Iron	Fe	56	II, III
Lead	Pb	207	II, IV
Magnesium	Mg	24	II
Manganese	Mn	55	II, IV
Mercury	Hg	200	I, II
Nitrogen	N	14	III, V
Oxygen	O	16	II
Phosphorus	P	31	III, V
Potassium	K	39	I
Silicon	Si	28	IV
Silver	Ag	108	I
Sodium	Na	23	I
Sulphur	S	32	II, IV
Tin	Sn	119	II, IV
Zinc	Zn	65	II

In connection with this lesson the following laboratory exercises are recommended:

1. Wet a strip of bright iron and expose to the air for a day or longer.

2. Sulphuric acid has the power of taking up water. Put a few drops upon a cube of sugar. It will turn brown, then black, and will be found to be carbon.

3. Potassium chlorate is a white salt consisting of potassium, chlorin, and oxygen gas. Heat about 5 grams in a test-tube. It will first melt, then seem to boil. Apply a glowing splinter to the gas escaping during the boiling.

4. Burn a small portion of sulphur. Note the odor of the gaseous product formed. What became of the sulphur?

CHAPTER XIV

A FEW FUNDAMENTAL LAWS AND PRINCIPLES

THE teaching of chemistry can be properly carried out when the theoretic instruction given in class is illustrated by experiments made in the laboratory. In every hospital there are easily available the common supplies and appliances needed to illustrate first lessons in chemistry. A simple outfit sufficient for a great number of chemical experiments would include the following:

A Bunsen burner; several test-tubes of different sizes; a test-tube rack; a glass rod; several pieces of glass and rubber tubing; a supply of corks; a pipet; a funnel; a horn spatula; a supply of filter paper; litmus paper—blue and pink; a chemical thermometer; a hydrometer, lactometer, and urinometer; a small asbestos mat; a supply of gum labels; a graduated cylinder; a mortar and pestle, and a set of scales used for weighing very small quantities.

A beginning can be made with the following list of drugs, by means of which a great variety of chemical processes and principles may be illustrated:

1 ounce of common washing soda.
1 ounce of baking soda.
2 ounces of sugar.
2 ounces of powdered sulphur.
½ ounce of powdered alum.
2 ounces of sulphuric acid.
2 ounces of hydrochloric acid.
1 ounce of tincture of iron.
1 ounce of chlorid of lime.
2 ounces of cornstarch.
1 ounce of tincture of iodin.
1 dram of solution of silver nitrate.
2 ounces of iron filings.
A few crystals of copper sulphate.
2 ounces of potassium chlorate.
2 ounces of nitric acid.

Chemists' Symbols.—As previously stated, in chemistry a system of symbols has been worked out and accepted. The symbols constitute the shorthand alphabet or sign language of the student of chemistry. It would be practically impossible for the average pupil in a hospital to remember the symbols which signify all the complicated compounds, the list of which is constantly increasing, but a study of the symbolic language used to designate the comparatively few which relate to common substances in daily use can be compassed by the earnest student who applies herself to the task, and is a great help in understanding the science. For example, oxygen is symbolized by the letter O, hydrogen by H, Carbon by C, sulphur by S.

A chemical symbol, therefore, represents the name of an element. It stands also for a definite weight of the element, which may be termed the symbol weight. O represents 16 parts by weight of oxygen. S represents 32 parts by weight of sulphur. The symbol is usually the initial letter of the name. In case of two or more elements having the same initial, two letters may be used, or the initial letter of the Latin name. Iron is represented by Fe from *ferrum*.

A *formula* represents the name of a compound. It consists of two or more symbols written together. The formula also stands for a definite weight called the formula weight. For example, CO_2 means 44 parts by weight of carbon dioxid.

Valence.—The power of an atom to combine with or displace a certain number of other atoms is called its valence. In formulas this must be raised to a common multiple, which is indicated by adding a little sub-figure after the symbol of the atom. For example, the formula of water, in which hydrogen with valence I unites with oxygen, valence II, must be H_2O. Sodium and chlorin each have a valence I, so the compound formed when they unite is NaCl. Again, carbon has a valence IV; its union with oxygen is represented by CO_2.

Reactions.—The term *chemical reaction* is used to in-

dicate the changes and interchanges among the elements by which new compounds are produced. The method by which the reaction is expressed or stated is termed *a chemical equation.*

A short way of writing out the kinds of atoms and how many of each are in a compound is also in general use. Each initial alone stands for a single atom. For example, "water is expressed by the symbols H_2O (H two O), meaning that in a molecule of water there are two atoms of hydrogen and one atom of oxygen. For carbon dioxid, the poisonous gas which we breathe out from the lungs, and which is formed when anything containing carbon is burned, chemists write CO_2 (CO two), meaning that in a molecule of this gas there are one atom of carbon and two of oxygen." (Ritchie.)

Physical and Chemical Changes.—Matter is anything which occupies space and possesses weight. Matter exists in three forms—solids, liquids, and gases.

Biology is the science which treats of living matter, of the structure, life, growth, and actions of living organisms.

The material world in which we live is constantly undergoing change. Matter is constantly being broken up. Compound substances are reduced to simple elements, and these simple substances are being built into new combinations. The term *biologic change* is applied to the changes which take place in our bodies, and which enable them to live and grow. Death results when these vital changes can no longer proceed in a normal healthy manner.

These changes are of two kinds—physical and chemical. Physical changes are more or less transient. They are changes of form. By the action of outside forces solids may become liquids, liquids may become gases, and the reverse is also true. For example, water is liquid at ordinary temperatures. At certain other temperatures it becomes ice, and at other temperatures it vaporizes or changes to steam. If these temperatures change, it again readily assumes its original form. A physical change does not involve the formation of a new substance.

A chemical change involves the formation of a new substance.

In the economy of nature nothing is lost. Wood and coal burn in our stoves. The invisible product of their combustion, CO_2, passes into the air, but adds a definite amount to the weight of the air. Thus the symbol of this product shows that 12 pounds of coal (which when free of ash is nearly pure carbon) in burning takes from the air 32 pounds of oxygen and gives back to the air 44 pounds of carbon dioxid.

Oxidation is the term applied to one of the most important chemical changes which takes place inside or outside the animal body. It indicates the union of oxygen from the air with another substance. Under the steam-boiler and in the stove it is called combustion. It is the chief source of available power or energy in either case. The same amount of heat is evolved when a given amount of substance is oxidized, whether the combustion takes place slowly or rapidly.

Experiments illustrating text of this lesson:

1. Write the formulas for compounds of the following·
   Calcium and chlorin.
   Mercury and iodin (two).
   Zinc and sulphur.
   Hydrogen and chlorin.
   Aluminium and bromin..
2. Heat an iron wire in a Bunsen flame. Is its composition affected?
3. Hold a piece of wood in a flame. (Compare with 2.)
4. Tear a piece of paper into bits so small they are as lint on the fingers. Is this a chemical or physical change?
5. Hold a piece of paper above a sink and apply a match. Gather some small bits and compare with 4.
6. Into a test-tube pour 5 c.c. of water. In this place about one gram of baking soda. Now add 4 or 5 drops of hydrochloric acid.
7. To show water is one of the products of combustion, hold a cold, dry beaker above a flame.

CHAPTER XV

SOME COMMON ELEMENTS AND COMPOUNDS

The atmosphere, or the air which surrounds us and which is essential to life, is a mixture of invisible gases, chiefly oxygen and nitrogen. In addition to these two principal substances, a certain proportion of watery vapor is found with small amounts of other gases, of which carbon dioxid is one.

The quantity of watery vapor in the air, termed *humidity*, is variable, and depends on numerous factors, especially the temperature of the air and the proximity of large bodies of water from which evaporation may take place. Humidity helps to retain the heat of the sun and contributes to the maintenance of animal and vegetable life.

Oxygen exists in the air in about the proportion of one-fifth to the whole. It is present in much larger quantity in the earth. It readily combines with most of the other elements. It is essential to respiration and to animal life. In combination with hydrogen it forms water. It is one of the important constituents of animal and plant substances.

Oxidation, or the union of oxygen with other elements, is always accompanied by heat. When oxidation takes place very quickly, and heat is evolved rapidly, a flame is produced. This process is termed *combustion*. The union of oxygen with matter frequently goes on so slowly that it is impossible to detect the process, though the results are invisible. The union of oxygen with iron produces iron rust—a form of iron oxid.

Nitrogen is an inert gas which forms almost four-fifths of the air. It dilutes the oxygen, the most active constituent of the air. In the form of protein it is one of the essentials of food, and is present in every living cell. It is taken up from the soil by the roots of plants, is one of the important constituents of fertilizers, and has an im-

portant place in the commerce of the world. Its important compounds—ammonia, saltpeter (potassium nitrate), nitric acid, and nitrous oxid or laughing gas—are largely used in the manufacture of medicines.

Hydrogen constitutes about 11 per cent. of water. "Combined with carbon it forms kerosene, gasoline, lubricating oils, and the other components of petroleum. Natural gas and illuminating gas are mixtures of free hydrogen, hydrogen compounds, and carbon monoxid. Hydrogen is a constituent of all plant and animal life. It comprises about 10 per cent. of the human body. Hydrogen is an essential constituent of all acids." (Irvin, Rivett, and Tatlock.)

Carbon is a constituent of all organic substances both animal and vegetable. Its compounds are very numerous. It is one of the important ingredients of diamonds, coal, coke, graphite, charcoal, soot, and lampblack.

Carbon dioxid, CO_2, is present in the atmosphere to the extent of about 3 parts in 10,000. "It is given off by the processes of decay and combustion of organic substances, by the respiration of animals, and by the burning of fuel." When carbon burns it combines with the oxygen of the air, forming an invisible compound gas called carbonic acid gas.

Chlorin is a poisonous yellowish-green gas of characteristic odor, extremely irritating to the mucous membrane when inhaled. It is contained in common salt, and, therefore, has an important place in human food. It is used extensively in bleaching powders. It has a strong affinity for hydrogen and for the metals. Chlorid of lime consists of lime saturated with chlorin. Three compounds of chlorin that are of great importance in medicine are hydrochloric acid, sodium chlorid, and potassium chlorate.

Bromin is one of the elementary substances. It derives its name from the Greek word *bromos* (a bad smell). It has decided resemblance to chlorin and manifests the same affinity. Many metals burn in it, forming

bromids, which are important medicinal agents. It is a dark red liquid, and when spilled on the hands produces sores which heal with difficulty.

Iodin is found in combination in the ashes of sea-weed. Traces of it are found in the thyroid gland. It dissolves freely in alcohol. In chemical characteristics and affinity it closely resembles chlorin and bromin. Several of its numerous compounds, the iodids, are valuable medicinal agents. It has important uses in photography.

Sulphur, a yellowish inflammable substance, is found widely distributed in animal and vegetable matters. It has strong affinities and combines with the majority of other important elements. The presence of sulphur in an egg is shown by the blackening of the silver spoon with which the egg is eaten, the sulphur from the egg and the metal from the spoon combining in sulphid of silver. Among its important compounds are magnesium sulphate and sulphuric acid.

Sodium and **potassium** are the two most important of the alkali metals. Sodium is found in nature chiefly in the form of sodium chlorid (common salt), deposits of which are found on every continent. Sodium chlorid is used extensively in making other sodium compounds, in the preparation and preserving of food, in the tanning industry, in the extracting of copper and silver from their ores, and as a glaze for earthenware.

Potassium is a silvery white shining metal. It is found in rocks and in the soil. Wood-ashes contain potassium, chiefly in the form of carbonate. Potassium nitrate or saltpeter is found in the soil, where it has been formed by the decay of animal substances. Potassium chlorate is used in the manufacture of oxygen, matches, fireworks, and explosives. It is frequently used in the form of tablets for sore throat. Potassium has numerous and important compounds—potassium hydrate, potassium chlorate, potassium iodid, potassium bromid, etc.

Calcium belongs to the group known as alkaline earth metals. In characteristics calcium, barium, and stron-

tium are similar. Calcium carbonate, $CaCO_3$, is one of the most abundant of the compounds found in the earth, chiefly in the form of limestone, used largely in the manufacture of lime, soda, glass, and cement. Calcium oxid, CaO, or quicklime, when exposed to the air, absorbs carbon dioxid and water and is gradually converted into hydroxid and carbonate. Calcium hydroxid dissolves slightly in water, forming lime-water.

Phosphorus plays an important part in the chemistry of animal and vegetable life. It is never found free or uncombined. It is found in nearly all soils, and is an essential constituent of bone and brain. Because it is known that plants do not flourish in soil that is barren of phosphorus the manufacture of bones into fertilizer has become a great commercial industry. It is used in the preparation of the friction match. It is strongly poisonous and combustible. Laborers in phosphorus works are subject to a painful disease, known as phosphorus necrosis, which has a destructive effect on the bones of the jaw. Phosphorus combines freely with oxygen. Sodium phosphate and calcium phosphate are common examples of its use in drugs.

Copper is used chiefly in medicine in the form of copper sulphate, a valuable cauterizing agent. It is one of the chief constituents of Bordeaux mixture used for spraying fruit trees.

Silver is used extensively in commerce. Silver nitrate or lunar caustic, and another compound, argyrol, are used for cauterization purposes.

Iron is one of the common metals of the earth. Some of its compounds are valuable drugs. It is found in the blood in the form of hemoglobin.

Mercury is a dense silver-white liquid. Because of its high specific gravity it is used in making barometers, and on account of its uniform expansion is used as the liquid in thermometers. It has numerous compounds, of which calomel (mild chlorid of mercury) is one. Bichlorid

of mercury is extensively used as a disinfectant, and has a strong corrosive effect on metals.

Zinc is a metal used in medicine, chiefly in the form of zinc oxid (also used in making paint); zinc sulphate, prepared by the action of sulphuric acid on zinc, used as an antiseptic, and zinc chlorid, a caustic.

Lead is used in medicine chiefly in the form of lead acetate or sugar of lead. Arsenate of lead is used in agriculture for destroying insect pests. All soluble lead compounds are poisonous.

Boron.—This element is found chiefly in the desert regions of the world in the form of boric acid and borax. Boric acid is extensively used as an antiseptic. Borax is used chiefly for laundry purposes and as a glaze in pottery.

Silicon constitutes more than one-fourth of the weight of the earth's crust. Its compounds have many uses in industries, such as the making of glass, porcelain, mortar, etc.

Bismuth is a crystalline metal with a reddish tinge. It does not combine with hydrogen. It is used in some of its compounds for toilet and medicinal purposes.

Caoutchouc (pronounced koo′chook), commonly known as india-rubber or gum elastic, is a hydrocarbon. It is the concrete juice of various trees and plants. From it a rubber cloth is made that excludes water and moisture.

Wax is a plastic substance deposited by insects or obtained from plants. The wax chiefly used in pharmacy is beeswax, from which honeycomb is made.

Fats and Oils.—Fats are combinations of fatty acids and glycerin. The molecules of fatty acids contain varying amounts of carbon and hydrogen with a trace of oxygen. Fats and oils are found in both the animal and vegetable kingdoms. Among the oils secured from plants are olive oil, cottonseed oil, linseed oil, peanut butter, etc. Some varieties of nuts have large amounts of fats.

Organic Compounds.—One of the peculiarities of organic elements and compounds is that they are all easily

combustible. Most of them were believed to be derived directly from the plant or animal kingdom, and it was found that on the application of heat they would first char (showing the presence of carbon) and burn up completely.

Through a long series of experiments it came to be recognized that organic compounds are made of carbon, hydrogen, and oxygen, with occasionally the addition of nitrogen, sulphur, or phosphorus. The belief that these substances could only be produced by the living cell, which prevailed for a long time, had finally to be abandoned, and today thousands of organic compounds are made artificially and new compounds are all the time being produced. The term *carbon compounds* indicates the most important group in the field of chemistry. "The organic molecule is built up around the carbon atom or, rather, around groups and chains of carbon atoms. Organic chemistry is sometimes described as the chemistry of the compounds of carbon." (Ottenberg.)

Synthesis is defined as the building up of a compound from its constituent elements, while the taking apart or the decomposition of the elements is termed *analysis*.

Synthetic chemistry—the making of new and ever new organic compounds—has progressed so rapidly in recent years that it now plays a tremendously important part in the industries of the world. Man has learned to do in various ways what nature has been doing in her own way from the beginning of the world. We use the products of synthetic chemistry every hour of our lives in some form—dye-stuffs, flavoring extracts, perfumes, medicines, foods, fabrics.

EXPERIMENTS

1. Prove the presence of carbon dioxid in the breath by blowing through a tube into 5 c.c. of lime-water.

2. Expose 5 c.c. of clear lime-water to the air for several hours. Result? When any insoluble compound is formed it is called a precipitate. Relate experiments (1) and (2).

3. To a test-tube half full of water add a little starch paste, then a few drops of tincture of iodin. This action

of free iodin and starch forms a distinctive test for both substances.

4. In a test-tube put three or four pieces of zinc, pour upon it about 8 c.c. of dilute sulphuric acid. Partially close the mouth of the test-tube and after a moment apply a flame. Let stand till action is completed. Then filter out any remaining portions of zinc, evaporate off the water, and notice the appearance of the product. It is zinc sulphate, and the escaping gas was hydrogen.

5. Put a few drops of a solution of silver nitrate upon a piece of filter-paper. Expose to the light and note its effect on silver compounds.

CHAPTER XVI

SOLUTIONS, ACIDS, BASES, AND SALTS

The term *solution* is used to designate a liquid with some other substance dissolved in it. Alcohol, ether, gasoline, chloroform, water, etc., have the power to hold other substances in solution. The substance, such as sugar, salt, etc., which is dissolved is called the *solute* and the liquid is termed the *solvent*. When water is mixed with other liquid, water is called the solvent. "The maximum quantity of the solute that a given amount of the solvent can contain in the presence of an excess of the solute is the solubility of the substance." With most solids the solubility is increased by heat. Certain substances are insoluble in water and easily dissolved in alcohol.

Saturated solutions are solutions which contain all the solute that can be held in solution at an ordinary temperature. In a supersaturated solution a certain amount of the matter to be dissolved settles down in solid particles. This deposit is known as the precipitate.

The freezing- and boiling-points of solutions suggest interesting chemical processes that can be widely illustrated

by experiments, with results that are common knowledge; for example, the custom of sprinkling salt on walks coated with ice or snow.

Deliquescence is the condition of becoming liquefied by the absorption of moisture from the air. Substances known as deliquescents should be kept in air-tight packages.

Efflorescence.—Certain crystalline salts lose their crystal form and become a powder when exposed to the air. This process is termed *efflorescence.*

Effervescence is the term applied to the commotion in a fluid produced by chemical reaction, in which some part of the mass escapes in gaseous form, producing small bubbles. The chemical reaction which takes place when the two parts of a seidlitz powder are dissolved separately in water and mixed is a familiar example. Ginger-ale and soda-water illustrate a process in which the liquid is charged with carbon dioxid under pressure. The carbon dioxid escapes when the pressure is reduced.

The large number of inorganic or mineral compounds may practically all be included in one of three great classes—acids, bases, and salts. Not all acids, however, come from minerals. Some of the most commonly used acids come from the animal and vegetable kingdoms. Acids manifest a special affinity for water. They are sour substances, all easily dissolved in water. The oxidation of an alcohol produces an acid. Important characteristics of acids are a sour taste, the power of neutralizing alkalies, and of changing the color of blue litmus-paper red. Most acids are powerful decomposing agents.

The *litmus test* is one of the simplest and most commonly used tests to determine the presence of acid in a substance. Litmus is a blue-colored substance or pigment secured from a plant, the lichen, found on trees and cliffs. Litmus paper is paper which has been soaked in litmus. It is turned red by any acid. In the absence of acid it is a purplish blue. Acids have an important part in the working of the different parts of the body. The stomach

juices on which the digestion of food largely depends always contain a certain proportion of hydrochloric acid.

Acetic acid gives to vinegar its sour taste. It is derived chiefly from alcohol as the result of fermentation.

Citric acid is found in large proportion in such fruits as lemons, oranges, grape-fruit, limes, etc., and in smaller quantities in berries and currants.

Malic acid is found chiefly in apples, pears, rhubarb, and the smaller fruits.

Tartaric acid is found chiefly in grapes.

Oxalic acid is found chiefly in rhubarb and in the plant called oxalis or sour-grass. It is strongly poisonous. It is used in photography and for removing ink, rust, and other stains.

Lactic acid is produced by the fermentation of milk-sugar. It is the acid found in sour milk. Lactic acid ferment is present in "lactone" and other tablets used to produce artificial souring of milk.

Butyric acid gives to butter its characteristic flavor.

Bases and Salts.—In chemistry the term *base* is applied to the non-acid part of a salt, or to the substance which combines with acids to form salts. The most important property of the bases is their ability to neutralize acids. They are formed by the combination of some metal with water, and play an important part in the intricate chemical processes of the body.

The terms *bases*, *hydroxids*, and *alkalies* are often used interchangeably, though there are certain differences between bases and alkalies. In general, an alkali is a soluble base.

An alkali is one of a class of compounds which form salts with acids and soaps with the fats. Important bases are ammonium hydroxid or ammonia-water, potassium hydroxid or caustic potash, sodium hydroxid or caustic soda, calcium hydroxid or slaked lime, magnesium hydroxid, used in making milk of magnesia, and ferric hydroxid.

The action of alkalies on fats resulting in soaps, cleaning

powders, etc., makes them useful for cleansing purposes. Alkalies and acids neutralize each other, but, owing to their strong irritative and corrosive effects, both have decided limitations which should be understood and observed.

Salts are substances resulting from the action of an acid on a base or metal. They are usually neutral in reaction, producing no change in litmus. As salts are formed by the union of an acid with a metal, different combinations of acids with metals form different salts. Hydrochloric acid forms chlorids, sulphuric acid forms sulphates, nitric acid forms nitrates, carbonic acid forms carbonates, phosphoric acid forms phosphates.

Salts have no true nutritional value, but are indispensable elements in our diet, and play a very important part in maintaining the health of the body.

The most abundant salt in nature is sodium chlorid or common salt. Potassium chlorid is similar in composition to sodium chlorid, and is used largely in the manufacture of fertilizers.

Ammonium chlorid or sal ammoniac is used widely in various industrial processes. In medicine it is classed as an expectorant.

Incompatibilities.—In chemistry certain elements and compounds refuse to mix with other substances without a chemic change being brought about. There is also a physiologic incompatibility which needs to be observed which makes it undesirable to administer one remedy with a certain other remedy because of their antagonistic effects. (See Poisons and Antidotes, page 341.)

EXPERIMENTS

1. Place a small crystal of copper sulphate in cold water. Now apply heat, and notice the change in the rate of solubility.

2. Put about 10 c.c. of water in a flask and boil it. Insert a thermometer and observe the temperature. Place 2 gm. of common salt in the water and ascertain the boiling temperature of the solution.

3. Test the following substances with litmus paper—vinegar, lemon juice, dilute solution of sulphuric acid.

4. Test the following with litmus paper, both red and blue—ammonia-water, lime-water, a solution of soda.

5. Put about 5 c.c. of weak ammonia-water in an evaporating dish, then add slowly dilute sulphuric acid until the litmus assumes a color intermediate between the red and the blue. During the addition of the acid stir constantly with a glass stirring rod. If you get too much acid, carefully add a drop or two of the base. Evaporate the solution almost to dryness, and observe the product. What is it? Test it with red and blue litmus.

CHAPTER XVII

PHYSIOLOGIC CHEMISTRY

The human body when analyzed is seen to be a collection of chemical substances which are constantly acting and reacting on each other. These chemical substances are taken into the body through the mouth and through the lungs, in the form of food, drugs, or poisons, or as oxygen from the air. Every substance swallowed is composed of chemical elements, which, when they enter the body, react with one another and with the tissues. The chief chemical constituents of the body are oxygen, hydrogen, carbon, nitrogen, calcium, phosphorus, and sulphur. Sodium, chlorin, potassium, iron, magnesium, and silicon are also present in small quantities.

The study which biologic chemistry, the chemistry of life, has received in recent years has contributed greatly to a clearer understanding of the normal processes of the body, and also to the changes produced in the body which result in disease.

Metabolism is the term used to indicate the change produced in a substance by the action of living cells upon it. It is the process by which living cells or organisms incorporate the elements obtained from food into a part of their own bodies. Various diseases, such as diabetes,

gout, uremia, etc., result from disturbance in some of the chemical processes of the body.

Food materials are necessary for the building and repairing of the tissues of the body, for the production of heat and energy or power, and for the regulation of the physical processes. Foods may be roughly divided into three great classes, according to their chemical constituents—body builders, fuels, and body regulators. The following table[1] illustrates the classes into which common food substances are ordinarily grouped, and the sources from which food elements are obtained:

I. Body Builders.—(*a*) *Muscle formers* (*protein*):
Milk and cheese.
Eggs.
Lean meat.
Nuts.
Legumes.
(*b*) *Bone formers:*
Milk.
Cereals.
Vegetables.
(*c*) *Blood formers:*
Water and beverages.
Fruits.
Vegetables.
Eggs.

II. Fuels.—(*a*) *Fats and oils:*
Butter.
Cream.
Olive and other oils.
Nuts.
(*b*) *Starches:*
Cereals.
Potatoes.
(*c*) *Sugars:*
Sugar-cane, beet, and maple.
Fruits.
Sweets.
(*d*) *Muscle formers* (same as above).

III. Body Regulators.—*Bulk* (*cellulose*):
Bran and whole cereals.
Coarse vegetables.
Fruits.
Whole cereals.

[1] From "Good Health Magazine."

Another form of food classification is into proteins, carbohydrates, fats, minerals, and water.

Vitamins.—New light which has been thrown on deficiency diseases and on malnutrition in general has emphasized the importance of certain accessory factors in diet, called vitamins, which seem to have an important part in nutritive processes. These elements are essential to growth, and the absence of vitamins from the diet is believed to be largely responsible for such diseases as beriberi, scurvy or rickets, pellagra, etc. Green vegetables, such as cabbage, carrots, etc., fruits, and certain cereals are relatively rich in vitamin substance.

The term *protein* is used to include the principal nitrogenous compounds whether of animal or vegetable origin.

Carbohydrates include all starches and sugars.

Fats include both those of solid and liquid consistency, called oils, whether obtained from the animal or plant world.

Digestion is defined as the process of changing foods into substances that will dissolve and pass through the walls of the alimentary canal into the body.

The production of heat is one of the important offices of food. In order that the chemical processes of the body may be maintained without disturbance, a certain degree of heat is necessary, and any prolonged variation from this normal temperature indicates disease. It is especially important that there be no considerable or continuous lowering of the temperature. Even a drop of one degree is a danger signal that should not be disregarded.

Foods, like all other organic substances, produce heat when they are burned. "Whenever a human being runs, walks, works, or studies he is enabled to do these things by burning up a certain amount of body fuel. When taken into the body, digested, assimilated, and used by the body, foods produce the same amount of heat as if burned outside of the body.

"*The Calorie.*—If the heat-producing value of food can

be reduced to terms of a standard measurement we have found a scientific unit of great value. This standard of measurement is termed a *calorie*. The calorimeter is an apparatus used for determining the caloric value of foods.

"A *respiratory calorimeter* has been devised to determine the caloric needs of the body. By means of such apparatus it is possible to discover the requirements of the body for nutriment under different conditions of work and rest; the duties performed by the different nutrients of food in supplying the needs of the body; and, finally, the nutritive value of food materials and the amount and proportions best adapted to the needs of people of different classes, with different occupations and in different conditions of life." (Richards.)

"The *caloric needs of the body* depend mainly upon activity and growth. 'Activity' includes both internal and external consumption of energy. It is most intense shortly after birth and grows gradually less toward old age, so that the infant a month or two old requires more calories per pound per twenty-four hours than ever again will be required. This, of course, is due to rapidity of growth in the early months. Growth is dependent upon rapid metabolism, and rapid metabolism requires a large amount of energy-producing food. Fifty calories per pound per twenty-four hours is required during the first three months of life; 45 calories per pound per twenty-four hours the second three months; and 40 calories per pound per twenty-four hours from the sixth to the twelfth month. This, of course, refers to the average healthy child.

"Caloric needs for adults past the period of growth are figured mainly on occupation and weight. For instance, $\frac{1}{2}$ calorie per pound per hour while sleeping; $\frac{3}{5}$ calorie per pound per hour while engaged in some light occupation while sitting, etc. Calories increase as activity of occupation increases. The method is very simple and approximately correct. Protein foods will be used to give about 15 per cent. of the total calories

during growth, and 10 per cent. for persons past twenty-five years of age. The remainder of the calories are provided by fats and carbohydrates, the latter always in excess of the former." (Cotton.)

TABLE OF CALORIFIC VALUES.

(After Frankland and Jurgensen)

Calorific Value of 100 Grams in Calories:

Apples	66.00	Egg, white of	67.10
Arrowroot	391.20	Egg, yelk of	342.30
Asparagus	18.50	Flounder	100.60
Bean soup	193.00	Flour	393.60
Beef, boiled	209.00	Macaroni	352.60
Beef, broiled	213.60	Mackerel	178.90
Beef, fat	906.90	Milk	66.20
Beef, lean	156.70	Milk, skimmed	39.61
Beef, raw	118.95	Oatmeal	400.40
Bread crumbs	223.10	Omelet	236.70
Bread, wheat	281.00	Pea-meal	393.60
Bread, wheat, toasted	258.80	Peas, green	318.00
Butter	814.00	Pigeon	99.70
Buttermilk	41.56	Potatoes	101.30
Cabbage	43.40	Rice, ground	318.30
Cakes	374.00	Salmon	133.30
Carp	93.00	Sugar, cane-	334.80
Carrots	41.00	Trout	106.40
Cheese, Cheshire	464.70	Veal cutlets, broiled	230.50
Chicken breast	106.40	Veal cutlets, raw	142.45
Cod-liver oil	910.70	Whiting	90.40
Cream	214.70	Zwieback	357.80
Egg, hard-boiled	238.30		

Digestive Fluids.—The exact chemical composition of the fluids of the body is important to be known in a great many of the disease conditions which nurses encounter. In previous chapters the composition of the blood and of urine was discussed. The digestive fluids have for many years afforded unlimited opportunity for research and experiment, and even yet the complex chemical processes by which the elements in food become chemically changed in the body are not clearly understood.

Enzymes are among the active substances by which many of the changes in food material are produced. Enzymes are defined as "protein-containing substances

of unknown composition produced by living cells, both animal and vegetable.'' Also as "complex chemic compounds capable of producing the transformation of some other compound. Most of the processes of both building and wasting in the animal body are controlled to some extent by enzymes. Each enzyme is able to work on one particular substance and on no other. On this account an enzyme has been compared to a key which will fit one particular lock, that is, will unlock one particular kind of molecule.'' They are produced in the mouth, stomach, pancreas, and intestines. All contain protein, but their exact composition is not known. All can be destroyed by boiling. Most of the digestive enzymes work best at body temperature, some require an alkaline solution in which to work, others acid, while some will work in either an alkaline or acid solution. Every living cell contains enzymes, commonly termed *ferments.*

Saliva is a mixture of secretions produced by the glands contained in the mouth. It is normally of a slightly alkaline reaction, but varies from acid to alkaline under various conditions. It contains one important enzyme, known as ptyalin, which begins the process of digestion by its action on starchy substances. Ptyalin works best in an alkaline or neutral fluid, and its work can be quickly checked by acids. Acids are quite as powerful in their destructive effect on ptyalin as is boiling.

The *gastric juice* is strongly acid in reaction, due to the presence of hydrochloric acid. The percentage of hydrochloric acid is variable. During digestion it is estimated at from 0.3 to 0.5 per cent. If this percentage is much lower or higher it interferes with the digestive process. Much of the so-called dyspepsia is due to the secretion of too much or too little hydrochloric acid.

Rennin and *pepsin* are the two important enzymes contained in the gastric fluids. Rennin coagulates milk—a condition necessary to digestion. It is difficult to separate from pepsin.

Pepsin may be prepared for medicinal use by making an extract from the stomach glands of a pig. The com-

mercial pepsin contains both pepsin and rennin. It begins the digestion of proteins.

Intestinal Digestion.—When the stomach discharges its food contents partially digested into the intestine they are at once acted on by the pancreatic fluids secreted by the pancreas. The pancreatic juice contains several important enzymes, and because through these different enzymes it is able to act on starches, proteins, and fats it is frequently termed the most important of the digestive secretions.

The bile secreted by the liver contains no enzymes, but assists in the emulsion of fats and promotes absorption. It also has an antiseptic action.

Examination of stomach contents and feces is a necessary procedure in many forms of gastric and intestinal disturbance. Among the most important points to be determined are the amount of acid in a given quantity of the stomach contents, the presence of blood, and the length of time required by the stomach to empty itself after a test-meal or test-food has been given.

In the examination of feces the most important single point to be determined is the presence of blood. Large amounts of blood are quickly detected, but small traces of blood are only discovered by careful chemical tests.

The presence of undigested fat in the stools shows an interference with the work which bile performs in the digestive process.

The *principal constituents of feces* are food residue combined with digestive fluids, bacteria, dead and active, and a small proportion of waste substances due to metabolism.

The *chemical constituents of urine* are necessary to be known in practically all disease conditions, since the kidneys are the chief excretory organs of the body, and are largely depended on to filter from the blood the waste products caused by the burning of nitrogenous food elements. They also assist in the elimination of superfluous salts, thus maintaining a proper salt balance, and, in general, are expected to rid the body of various

other poisonous substances manufactured in and by the body.

Urine is composed of urea and uric acid, both of which are nitrogenous substances, various salts, dissolved gases, with a relatively large amount of water. (See chapter on The Urinary System, page 112.)

The Chemistry of Cooking.—In cooking, raw materials in the form of food substances are changed by the action of heat into substances more palatable and more easily digested. Certain substances become partly digested in the cooking process.

Solution occupies a large place in the chemistry of cooking and digestion. In fact, it is often stated that "digestion is primarily synonymous with solution. All solid food materials must become practically soluble before they can pass through the walls of the digestive system. Starch must be transformed into soluble crystalline substances before absorption can take place. Cane-sugar has to undergo a chemical change before it can be absorbed." (See chapter on Principles of Nutrition, page 353.)

The general principles on which the conversion of starch into sugar and sugar into alcohol is brought about afford an interesting line of experiment for students of elementary chemistry.

Starch Conversion.—"There are two distinct means by which starch conversion is produced. One is by the use of acid and heat, which changes the starch into sugar, but can go no further. The other is by the use of a class of substances called ferments, some of which have the power of changing the starch into sugar, and others of changing the sugar into alcohol and carbon dioxid. These ferments are in great variety, and the seeds of some of them are always present in the air. Among the chemical substances called ferments, one is formed in sprouting grain, which is called diastase or starch converter, which first, under the influence of warmth, changes the starch into a sugar, as is seen in the preparation of malt for brewing. The starch first takes up water, and under the influence of the ferment is changed into maltose. Cane-

sugar is readily converted into two sugars, dextrose and levulose." (Richards.)

The production of flavors in foods and beverages on which so much of the enjoyment of food depends is due to subtle chemical changes not clearly understood, but unmistakable in results. A hundred familiar illustrations could be given. For example, study the change produced in the coffee berry by roasting. Under the influence of heat a chemical substance existing in the berry is broken up and new chemical compounds are produced. Too much or too little heat adversely affects the process by which the desired compounds which give the right flavor are produced. The same thing occurs in the toasting of bread, the roasting of meat, corn, etc. The chemistry of cooking is to a large extent the chemistry of flavor production—the application of heat to the food material in such a way as to bring about the right changes, and only these.

EXPERIMENTS

1. Conversion of starch to glucose: Boil 5 grams of cornstarch with a weak solution of sulphuric acid. From time to time test by adding a drop by means of a stirring rod to a drop of tincture of iodin in an evaporating dish.

2. Upon some starch paste put a quantity of saliva. Let stand and test every few seconds, as in 1.

3. Digestion of proteins: In a test-tube put $\frac{1}{4}$ gram of white of egg and 10 c.c. of an acidulated pepsin solution. Keep warm and let stand for several days. Note result.

4. Note the result of commercial rennet on milk in the preparation of junket.

5. Digestion of fats: To 10 c.c. of milk in a test-tube add 3 c.c. of fresh pancreatin extract obtained by grinding a few grams of fresh pancreas in a mortar and adding a little water. Keep the tube warm and test from time to time with blue litmus paper.

6. Testing urine: Fill a test-tube half full of urine. Apply a flame to the top of the liquid until boiling takes place. If the liquid becomes turbid and this does not

disappear when a drop of nitric acid is added, it indicates the presence of albumin.

7. Test for presence of glucose by taking equal parts of urine and Fehling's solution and boiling together. If sugar is present there will be a characteristic color change.

CHAPTER XVIII

CHEMISTRY AND CLEANING

In the discharge of every-day household duties every individual is performing more or less complex chemical experiments. "Every match that is lighted, every use of soap on the body, the clothing, or utensils, depends upon chemical laws for the reactions which take place. Therefore, to some extent, every house is a laboratory. An understanding of simple chemical reactions tends to economy in household management." (Richards.)

Most household laboratories are supplied with *alkalies* in the form of concentrated lye, used for removing grease from drain pipes and for making soap; sodium carbonate, or sal soda, common washing soda, used for softening hard water; sodium bicarbonate or baking soda, used to neutralize acids in cooking; borax, also used to soften hard water and as a bleacher and antiseptic; ammonia, used in a variety of cleaning processes; soap in cakes, chips, or powder, also in semiliquid (soft soap) and liquid form.

Acids in the form of vinegar (acetic acid), sour milk (lactic acid), and lemons, oranges, etc. (citric acid) enter largely into every-day diet, while various acids are used in cleansing and bleaching processes.

The effects of various chemicals on the substances to be cleansed should be understood and observed. Many of them have a violent corrosive effect which will destroy metals or eat holes in a fabric unless the chemical is thoroughly washed out or neutralized by another chemical of an opposite nature.

Dust and Dirt.—The removal of dust and dirt constitutes a considerable part of the daily labor of civilized

human beings. Dust has been defined as "earth or other matter in fine dry particles so attenuated that they can be raised by the wind." Dust when analyzed contains mineral matter, animal waste, and vegetable débris, but it contains another ingredient which, from a sanitary standpoint, is more important than any other. It contains minute vegetable organisms known as bacteria, yeasts, and molds, commonly spoken of as germs, but they are capable of developing into growing forms. Most are plants belonging to the fungi. In their manner of life they are essentially like the plants we see, requiring food, growing, and reproducing their kind. They require moisture in order to grow or multiply, but, like the seeds of higher plants, can take on a condition calculated to resist hard times and endure these for long periods; then when moisture is furnished they immediately spring into growth.

"It is recognized that the air everywhere contains the spores of molds and bacteria, and it is this dust carried in the air which falls in our houses and constitutes an enemy to health." (Richards.) All bacteria, yeasts, and molds are not harmful. The majority are friendly to health, and work continuously to produce the chemical changes on which animal and vegetable life depends. (See page 188.)

The mixture of dust with grease and with sugary or smoky deposits adds greatly to the problem of cleanliness. To combat these compounds, which we recognize as dirt, a great variety of chemical mixtures have been worked out, different materials requiring different chemical products to render them clean and wholesome. The fact that the greasy film combined with dust settles on materials of widely different character—wood, metal, minerals, leather, paper, fabrics, etc., each requiring the use of special chemicals—has presented a great variety of chemical problems and opens a wide field for the young student's experiments. The inflammable nature of many of the chemicals used in cleansing should be borne in mind.

Paints and Varnish.—The care and cleaning which these substances receive determine to a considerable extent their beauty and durability. The use of the wrong kind of

chemical on paint or varnish often effectually removes it and mars an otherwise beautiful surface. A familiar example of this sort of chemical reaction is seen when a piece of wet laundry soap is left on a varnished table. The effect of heat on a varnished surface is equally disastrous. The exact cause of these effects can be shown by a variety of chemical experiments.

Poisons and Antidotes.—Many of the commonly used cleaning substances, disinfectants, etc., are strongly poisonous when taken into the body. A solution of bichlorid of mercury, one of the commonest disinfectants, given by nurses in mistake for a dose of a solution of magnesium sulphate (Epsom salts) has been the cause of numerous deaths in hospitals. Too strong solutions of carbolic acid, corrosive sublimate, etc., burn the tissues if they do not cause death.

Because a nurse is constantly handling and using powerful chemical substances every nurse should study to be extremely careful in reading labels, and should familiarize herself with the antidotes for the strongly poisonous drugs in common use in hospitals. (See page 341.)

SUGGESTIONS FOR EXPERIMENTS

1. Try to remove iron rust stains from a piece of cloth with hydrochloric acid. Note the effect on the cloth if the acid is left in the fabric; also, if after using the acid, the cloth is washed in weak ammonia-water.

2. Remove an ink spot by the use of a solution of oxalic acid. After stain is removed be sure the acid is washed from the fabric.

3. Use a little turpentine to remove a paint stain.

4. Try borax and cold water on a chocolate stain.

5. Note the stain produced by a drop of nitric acid on the skin. The skin is protein, and this action is often used as a test for the presence of protein matter.

6. As acid and alkali are opposed in their effect, note by means of litmus paper the counteraction of lime-water and soapsuds upon any acid poison, and of lemon-juice or dilute vinegar upon ammonia-water or lye.

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SECTION III

HYGIENE

CHAPTER XIX

GENERAL HYGIENE

Hygiene is defined as that department of sanitary science which treats of the preservation of health. The goddess of health, Hygeia, of Grecian mythology, was the daughter of Æsculapius, the god of medicine. Hygiene is probably the oldest of the sciences. The Levitical code given by Moses provided definite regulations as to methods of preventing disease among the ancient Israelites—duties which were to be observed as a part of their religious rites. Imperative directions regarding cleanliness, food, the isolation of persons affected with certain diseases, and the methods of cleansing to be employed after the disease had spent itself, are contained therein. The science of hygiene, as we know it to-day, is the result of the evolution of centuries of thought and study as to the best methods of preventing disease and accident, and thereby preserving health.

Health has been defined as "perfect circulation of the blood and perfect elimination of the waste products from the blood."

"Health is the faculty of performing all actions proper to the human body in a perfect manner."

"Health is the perfect circulation of pure blood in a sound organism."

Requirements for Health.—How to preserve this condition is the object of the study of sanitary science

or hygiene. To keep the body in health requires for it a proper proportion of air, water, food, exercise, and rest. No individual can expect to continue in health when deprived of a just proportion of any of these physiologic requirements.

A general and thorough study of hygiene would include the home or habitation in which an individual dwells; the soil and surroundings; the methods of providing warmth and light; the air he breathes; the food and water he uses; the clothing he wears; the proper disposal of the excreta of the body and other refuse; his habits of exercise and rest, his occupation, and the common causes of disease, especially of preventable diseases.

Friends and Enemies of Health.—The maintenance of life and also the diseases commonly classed as preventable have both been found to be dependent on the activity of minute organisms which are invisible to the naked eye, which are commonly known as bacteria or germs. These may be divided into two main classes: those which are friendly to life and health and those which are destructive. Animal life is dependent on vegetable life. Vegetable life is dependent on certain qualities in the soil, each blade of grass and plant appropriating from the elements of the soil the material needed for its growth. If the earth is to continue to produce the vegetation on which animal life depends, the elements drawn from it by plants must in some way be restored to it. The restoring of these elements is dependent on these little invisible friends, the germs. Through their increasing activity dead plant and animal matter is disintegrated, broken up into simple elements, to be again absorbed by the earth and again used to produce vegetation.

These good germs are the scavengers of the earth, feeding on dead waste matter and rendering harmless many objects which would otherwise be destructive to life.

Disease-producing germs exist always at the expense of

TABLE OF INFECTIOUS DISEASES (Fevers)[1]

Disease	Age	When Most Prevalent	Mode of Infection	Incubation Period	Symptoms on Invasion, Advance, etc.	
Diphtheria..........	All ages, Nurses very liable, and children (2 to 8 years especially).	October to December, Epidemics.	Air, Clothing, Room, Saliva, Nasal Discharges, etc., *Infected milk*, Cat, Toys, Bacillus Diphtheriæ.	Usually 2 days; it may be 2 to 10.	Grayish-white membrane—second day of illness. On tonsil, uvula, etc. Advance: fever, great debility, *weak heart.*	Sore throat may resemble Scarlet fever. Great danger from weakness of heart on exertion. Only free from infection when germs are absent from throat, etc. (Bacteriological examination necessary.)
Pneumonia..........	Any age, chiefly old people.	Spring and Winter.	Bacillus Pneumoniæ.	Short: 2 to 3 days.	Early rigor. Lung symptoms.	Infectious during attack.
Scarlet Fever or Scarlatina.	All ages, specially children 4 to 7 years.	November and December, Epidemics.	Direct Contagion, Breath, Skin, Clothes, Books. Milk specially (cow may probably get the disease). Discharges from ears and nose of patient are very infectious. Special germ unknown. Epidemics vary in intensity.	Usually 2 to 4 days (1 to 7).	Rash on second day of illness on upper part of chest, front and sides of neck, sore throat. (In children vomiting is an early symptom.) Fever later—finally desquamation ("skinning").	Resembles Small-pox, Measles, Diphtheria, Sore throat. Is one of the most fatal diseases of children. Free from infection after six weeks from commencement of disease, and when discharges from ears, nose, etc., and desquamation have ceased, probably after six weeks of commencement of illness. (Bacteriological examination necessary.)
Erysipelas...........	Adults over 40. Surgical and Post Partum cases. Children.	Spring.	Contagion. Inoculation wounds. Germ of erysipelas.	Usually 3 days (3 to 7).	Redness on second day of illness on inner angle of eye, internal ear, etc. "Blebs," swelling of face, high fever, delirium, etc. Desquamation later.	Dangerous for old people and chronic alcoholics, and in puerperal cases. Free from infection when skin has finished peeling.
Measles.............	Young children chiefly.	June and December. Epidemics differ in severity.	Specially infectious before and during rash. Neighborhood of patient, Air, Clothes. Discharges from nose, mouth, skin.	10 to 12 days.	Rash on fourth day of illness. Usually first on forehead, at roots of hair and behind ears. "Koplik's spots" (inside cheeks).	Resembles *German Measles*, Small-pox, Scarlet fever. Infected child should be isolated. Causes many deaths, and predisposes to *"Consumption" of the lungs later.* Free from infection after all rash, etc., has disappeared, probably three weeks after commencement of disease if attack is mild.
Small-pox...........	Any age if unvaccinated.	Spring and Autumn, Epidemics.	Patients are infectious before rash appears. Air, Clothing, Skin, etc. Germ uncertain.	Usually 12 days.	Rash on third day of illness, usually first on face. Previously, intense backache. Headache, vomiting or earlier red "blush." Later, secondary fever, "blebs," pustules, desquamation, etc.	Resemble Measles, Scarlet fever. Free from infection after all scabs and desquamation have disappeared.
Typhus Fever........	All ages.	Winter Epidemics severe but infrequent.	Very infectious, especially near patient and during second week of illness. Bedding, Clothing, Furniture long retain poison. Germ not known. Especially among filthy surroundings. Overcrowding. Nurses are very liable to infection.	Usually 12 days (2 to 14).	Rash ("Mulberry") on fifth day of illness. Usually on abdomen, chest, backs of hands. *Face and neck usually free.* Symptoms rapidly developed: rigors, vomiting, flushed face and eyes. Disease usually terminates with *a crisis.*	One of the most infectious diseases. Now seldom seen except among very poor and dirty people. Deaths among children few. Free from infection after cessation of fever, probably six weeks after commencement of disease.
Typhoid Fever.......	Chiefly young male adults.	October, November, December.	Water and Milk, Oysters, Cockles, Vegetables, Defective drains, etc., Flies, Excreta. Bacillus Typhosus.	About 14 days (5 to 23).	Rash at end of first week: *few* small rose-pink spots on abdomen, chest. Later intestinal symptoms. Characteristic temperature chart. Lysis or crisis at end of fever.	Resembles Influenza. Later appearance of rash distinguishes it from Scarlet fever, Small-pox, and Typhus fever. Relapses may occur. Convalescence slow. Free from infection probably after six weeks. Bacteriological examination necessary.
Chicken-pox or Varicella.	Children specially.	Spring, Autumn, Epidemics.	Germ unknown. Air, Clothing, Contacts.	Usually 14 days.	Rash (seen first day of illness on chest, back, etc.). Slight fever, successive crops, each lasting 3 to 4 days.	Free from infection after skin has become normal. Probably two weeks from commencement of illness.
German Measles..... (Rotheln)	Children or adults.	March to June.	Immediate neighborhood of patient, infectious Clothing, etc.	Usually 16 to 18 days.	Rash on second or third day of illness. Pink spots on face first. Enlarged glands in neck. Sore throat. Slight fever—3 days.	Free from infection when skin is normal, probably after three weeks from commencement of illness.

Nurses should make it clear to Parents, etc., that mildness of the attack in one person *does not lessen the chances of another taking the infection*, or of having a *virulent type of the disease.*

[1] From Hygiene for Nurses, Herbert W. G. MacLeod, B. Sc., M. D.

some living creature. They are commonly classed as pathogenic organisms, pathogenic bacteria, or parasites. In various ways they gain an entrance to the human system, take from it substances necessary to health, and produce within the body substances poisonous to the tissues of the part attacked by them.

These germs require for their life and development warmth, moisture, and material on which to feed. They may gain entrance to the body and accomplish no harm because the natural resistive powers of the body are sufficient to overcome them or to hold them in check. If the resistive power is lowered from any cause and there is not sufficient vigor to overcome the bacteria, the latter create in the body a form of poison known as ptomains or toxins.

The Spread of Disease.—Among the common methods by which pathogenic germs are spread are:

1. By means of dust the germs may, when dry, be distributed through the air.

2. By being washed over the surface of the earth or by filtering through the ground they may infect the water supply. (It is claimed, however, that disease germs are rarely found lower in the earth than 5 or 6 feet, certain elements in the earth having the power to destroy them in course of time.)

3. By means of flies they may be deposited on food or drink.

4. By means of clothing, soiled boots, or animals.

5. By direct contact through handling.

6. By means of mosquitoes.

AIR

Air is the most immediate necessity of life. It consists of oxygen, nitrogen, carbonic acid, ozone, mineral salts, organic matter in varying proportions, and a variable amount of watery vapor. The proportion of the first three gases which compose the bulk of the ordinary air is said to vary very little in different parts of the world.

Ozone is said to be generally absent from the air in cities. The purest air is found on high mountains and over the sea.

Contamination of Air.—Air is contaminated by the breath of men and animals; by the decomposition of animal and vegetable substances; by combustion of coal, gas, etc., and by various manufacturing industries. In the ordinary air there is always a certain amount of suspended matter consisting of minute particles of sand, soot, wool, decomposed animal and vegetable matter mixed with germs, good and bad—in fact, particles of almost every conceivable thing. In mining districts or manufacturing towns the air is usually loaded with particles of mineral matter.

Purification of Air.—Nature has arranged for the purification of the air, provided man does his part or does not thwart her in her efforts. This is accomplished by the winds, which bring pure air and carry away impurities; by rain, which cleanses the air by carrying down with it the suspended matter and depositing it on the earth; by the chemical action of oxygen and ozone on the impurities; and by the power possessed by the vegetable creation of absorbing carbonic acid gas and giving off oxygen. If these natural forces are not impeded, the composition of the air will remain uniformly pure.

Oxygen is the constituent most important for the animal world, carbonic acid for the vegetable world. Without a certain proportion of oxygen life cannot be maintained. The blood is purified by its contact with oxygen in the lungs, hence, unless oxygen is supplied the blood must retain its impurities.

The **purity of air** in living rooms chiefly depends on the provision made for the escape of foul air, for the entrance of abundance of fresh outside air, and the amount of space for each individual. Each person is throwing off organic matter from the skin and vapor from the lungs, which, if not allowed to escape, quickly vitiates the air. The burning of gas and coal rapidly

exhausts the oxygen in the air and leaves instead injurious gases. The locality and sanitary surroundings also affect the quality of the air. Filth, in the form of decomposing animal or vegetable matter, or the gases arising from damp marshy ground, will rapidly load the air with impurities and make it a menace to health.

Scientists have shown that about 3000 cubic feet of pure air per hour should be supplied for each person. The organic matter thrown off in the exhalations from the body tends to collect in the lower strata of air and a certain amount of floor space is necessary. The height of a room does not make up for deficiency in floor space.

Ventilation may be either natural or artificial.

Natural ventilation in houses is accomplished by means of doors, windows, and the cracks and crevices around the skirting boards, window-sashes, etc. An open fireplace provides for the escape of impure air, but some other opening is necessary for the admission of pure air. If a proper distribution of air is to be accomplished and draughts prevented, fresh air should be admitted from above the head. Good ventilation requires that the incoming air shall penetrate into all parts of the room and combine with the air already present. A strong draught or air current may pass through a room, affect only the air between the points of inlet and outlet, leaving the air in other parts of the room unchanged. It is an important part of a nurse's duty, whether in hospital or home, to see that her patients are supplied with an abundance of clean air, and no amount of energy expended in maintaining cleanliness in other directions can compensate for carelessness in this matter, which concerns a vital necessity to health and life. In the hospital the nurse will probably be charged with the adjustment of ventilators as well as the regulation of the natural means of ventilation and the protection from draughts. In a home she may have to improvise her own methods of ventilation. One of the simplest methods of securing good and constant ventilation where no ventilating flues

are provided is by placing a 2-inch board underneath the lower sash of a window, thus admitting a constant supply of fresh air between the sashes and over the head, where it is readily warmed and diffused. A less desirable method is to cover the patient well, using a screen of some kind to protect from draughts, and open windows and doors two or three times daily, till the air in the room is thoroughly changed.

In cold weather it is important to maintain an even temperature where the sick are concerned, but this should not be secured by retaining impure air in the room. Florence Nightingale has said that "Of all methods of keeping patients warm, the very worst certainly is to depend for heat on the breath and bodies of the sick." A thermometer indicating the temperature of the atmosphere is almost a necessity in a well-conducted sick room. It is not at all necessary, however, to chill a room in order to ventilate it, nor is coldness of the atmosphere in a room any sign of its purity. A room may occasionally be indirectly ventilated by filling an adjoining room with fresh air and opening a door, but whenever it can be accomplished without draughts or chilling the patient, direct ventilation is desirable.

Ordinarily a temperature of 65° F. for a sick room will be warm enough, but in cases where the blood is impoverished and the circulation poor, as it often is with aged individuals, a slightly warmer atmosphere may be necessary. Many cases, notably pneumonia and some forms of fever, rapidly improve under the influence of cold outdoor air, the improvement being attributed not solely to the abundance of fresh pure air, but to the coldness of the air, which seems to stimulate and energize. The subject of atmospheric temperature and ventilation is regarded as more important in the treatment of the sick than ever before, and due attention should certainly be given to the practical aspects of the subject by every nurse, whatever the class of patients she may be nursing.

Artificial ventilat on is accomplished by extracting the

impure air and forcing in pure air by mechanical methods. In this way the amount of air entering can be accurately regulated. It can be filtered, warmed, or cooled, according to the system of ventilation and machinery provided. It is, however, not considered wise, even with the most perfect ventilating system that has yet been devised, to ignore natural methods of ventilation entirely, and rely on machinery to do what Nature would do if allowed to.

WATER

Water forms about two-thirds of the weight of the body and is one of the prime necessities of life. In order to be wholesome for use in the body water should have the following qualities:

It should be transparent and without color.

It should have no particles suspended in it.

It should have neither taste nor odor.

It should be aërated.

It should be free from pathogenic germs.

It has been found that water may possess the first four qualities and still be exceedingly unwholesome. In other words, clearness of water is no guarantee of its purity. It has been found that water which looked clear as crystal contained enough typhoid fever germs to infect a whole village.

Sources of Water-supply.—The natural sources of water are the rain and the snow. A portion of this water that falls evaporates, another part sinks into the earth, and the remainder flows off the surface to swell the rivers and other bodies of water.

Water is a combination of hydrogen and oxygen. It freezes at 32° F. and boils at 212° F. All natural waters contain a certain proportion of mineral salts, notably lime. They are said to be hard or soft, according to the amount of mineral salts contained.

Contamination of a water-supply may take place from drainage from barnyards, cesspools, closets, sewers,

surface soakage, or by moulds, ferments, or decaying animal or vegetable matter of any kind.

Purification is effected in various ways. The soil acts as a natural filter. Spring water issuing from its depths is usually pure and wholesome, unless passage through limestone deposits has rendered it too hard. Oxygen exists abundantly in the soil and serves the purpose of destroying decaying animal and vegetable matter which may soak in from the surface.

Distillation is said to more completely purify water than any other method used. It is largely used at sea. Most large steamships have a condensing apparatus for producing distilled water from sea-water. It needs to be aërated before being used.

The *boiling of water* diminishes the "hardness" due to mineral salts; the carbonic acid and other volatile gases which have been dissolved in the water are driven out and the mineral substances deposited in the bottom of the vessel. Excess of mineral substance in water may cause digestive disturbance, and is believed in some cases to have exercised a decided influence in causing calculous diseases. Regarding the purifying of water, Parkes says: "We have the strongest reason for believing that distillation and boiling effectually destroy all organized living matter in the water except the spores of some bacteria. There can be little doubt but that the specific poisons of cholera, enteric fever, and of other diseases occasionally propogated by means of impure drinking water are effectually destroyed by even a few minutes' boiling."

Chemical purification of water is sometimes attempted, but the methods employed are rarely reliable. Alum, about 6 grains to the gallon, is often used where the water is muddy or turbid. It precipitates the suspended earthy substances, but does not destroy disease germs. Perchlorid of iron and potassium permanganate are also used for the same purpose.

Filters, especially domestic filters, are useful for clearing

the water of floating particles, but experiments have proved that they are often a source of pollution of water rather than of purification. The filter that will run fast is usually the favorite. So long as the water will flow through it at a satisfactory speed it is rarely cleaned. Its pores become clogged with putrefying matter. Whatever is taken out of the water stays in the filter till it is cleansed, and it is not at all unusual to find, on examining filtered water for bacteria, that it contains many times more the number of disease germs than unfiltered water from the same main source. "Put not your trust in filters" is a good rule to observe if there is reason to believe that drinking water contains disease germs.

Diseases Produced by Impure Water.—Certain forms of dyspepsia and diarrhea are often produced by excess of mineral salts in water, especially in those unaccustomed to it. The most common diseases attributed to an impure water-supply are typhoid fever, dysentery, and cholera. Diphtheria and tuberculosis may be carried by water. Metallic poisoning occasionally occurs by the use of water polluted with refuse from mines, and from absorption of metals used in pipes and tanks.

Excessive drinking of water is sometimes ascribed as a cause of disease, but, if taken at the right time, it is rare that pure water will cause harm. Too much mineral water may cause trouble from the excess of the mineral element. By far a greater amount of disorder is caused by taking too little water. The human machinery is very liable to become clogged by its own waste products if plenty of water is not supplied for the cleansing of the tissues.

Ice.—The idea that water purifies itself in freezing is no longer accepted. It has been proved again and again that disease germs may live in a dormant state in ice for months, and many epidemics of disease have been caused by the use of polluted ice.

FOODS

The study of foods will be taken up more fully in the lessons on dietetics. The subject of "pure foods" is one that is receiving a vast amount of attention from scientists and from the general public, and the nurse is urged to avail herself of the current literature on the subject. Overeating is regarded as one of the very common causes of disease. When too much food is eaten, the digestive organs are unable to satisfactorily deal with it. The undigested portion undergoes fermentation and putrefaction, owing to the bacteria always present in the intestines. Fetid gases are formed, and dyspepsia, diarrhea, and other digestive disorders are the result. Other symptoms are torpor, headache, fetid breath, fever, and hyperacidity of the stomach contents. The organs of elimination may, through overwork in attempting to excrete an excessive amount of waste matter, become weakened or diseased.

Deficiency in diet or of some of the necessary food elements tends to general debility, loss of body weight, anemia, and may predispose to rickets, scurvy, tuberculosis, and scrofula.

Milk is one of the most important and necessary of all foods. Being an animal product, its quality necessarily varies with the condition of the animal's health and the general conditions surrounding it. The food supplied to the cow, the degree of cleanliness or filth maintained in securing and handling the milk, will determine to a considerable degree its quality. The germs of tuberculosis and other diseases with which the bovine creation may be afflicted are liable to be produced in milk. Pure milk from a perfectly healthy cow may quickly become impure by careless handling. The washing of milk vessels in water containing the germs of typhoid fever, scarlet fever, and other diseases is a fruitful source of contamination. Milk forms an excellent food for germs as well as for human beings, and bacteria and other low

forms of living organisms flourish in it. It also absorbs odors from being put in open vessels in the same refrigerator with meat, fish, vegetables, etc. The proportion of fat or cream from the same cow will vary, but unscrupulous dealers are probably the most frequent cause of variation in cream.

Adulteration.—Three principal methods of adulteration are practised: Water is added, cream is removed, and certain chemicals are added as preservatives. When water is added or cream is removed the nutritive value of the milk is lessened. The drugs most frequently used as preservatives are boracic acid, borax, salicylic acid, and formaldehyd. The injurious effects of chemically preserved milk depend on the amount consumed and of the drug used.

Where there is reason to suspect the purity of the milk, sterilizing or pasteurizing it is sometimes employed. Sterilizing or boiling the milk kills the germs, but is said to lessen its digestibility. Pasteurizing consists in subjecting the milk to a temperature of about 167° F. for a half hour and then quickly cooling it. It is claimed that by this process the injurious germs are destroyed and the digestibility is not lessened.

Meat or **flesh foods** contain the same chemical elements as the human body and are, as a rule, more easily and completely digested than vegetable foods. Excess of meat eating, however, is blamed for deterioration in health in a great many cases by inability of the body to digest or appropriate the nutritive matter and of the organs of elimination to get rid of the waste products. Flesh foods are often the medium by which injurious parasites enter the body. Dangerous toxins or poisons may develop through the action of bacteria in meat. Ptomain poisoning may result from various foods, but putrefying or spoiled meat, poultry, game, milk, oysters, and fish are probably the most frequent causes. Metallic poisoning frequently occurs from the use of food cooked or allowed to stand in brass or copper vessels. It may

also be caused by the use of canned goods, either vegetable or meat, that have been kept too long in tin or that have been allowed to remain in the tin after opening.

Meat, like milk, is an excellent material for the development of bacteria, and many cases of poisoning have resulted from sausages, meat pies, or partially decomposed or refuse meat which has been unaltered in taste.

Vegetables which are boiled or otherwise cooked are usually safe forms of food, and the same is true of fruits. Vegetables which are eaten raw, such as celery, radishes, and lettuce, may in themselves be in good condition, but by being washed in contaminated water may become the medium for carrying infection into the system.

Food adulteration is the addition of injurious substances to food or the fraudulent use of cheaper articles than the one represented. Many of these adulterations are not injurious in their effect on health. Milk is an important exception to this latter statement. The foods most frequently adulterated are butter, canned goods, flour, coffee, minced meats, milk, preserved fruits, spices, and syrups. The methods of adulteration are exceedingly varied and need not be entered into here.

CHAPTER XX

GENERAL HYGIENE (*Continued*)

THE location of a house or hospital, the nature of the soil on which it is built, and the general surroundings will very decidedly affect the health of its occupants; but the most wisely constructed and advantageously situated building may very soon become unsanitary and a breeding place for disease if daily sanitary precautions are not taken.

The idea is generally accepted that a porous soil containing gravel or sand is the most desirable, if one has a choice, and other considerations are equal. Such a soil is not favorable to dampness, which is always to be avoided in a location if possible. It is believed that dampness predisposes to many forms of disease, especially diseases of the respiratory organs and rheumatism. An elevated position favors natural drainage. A low, marshy soil should be avoided.

While a certain amount of shade is desirable around a dwelling of any kind, yet too many trees prevent the entrance of sunlight and air and tend to make a house damp—conditions which are all favorable to the development of disease-producing bacteria.

The material used in the construction of a building is much less important than the habits of those who are to occupy it, so far as health is concerned. A shack may be rudely and cheaply constructed, but perfectly sanitary, a palace may be the opposite. In any building the provision made for disposing of refuse of all kinds is an exceedingly important consideration.

Plumbing.—The plumbing system, the mode of installation and care in the modern home and especially in a hospital, influences very materially the health of those who occupy the dwelling. The cost of repairs and upkeep of plumbing depends to a large extent on the general precautions and care observed in the daily routine.

"There are eight points to be observed in plumbing installation, viz.:

"(1) System should be simple, compact, easily accessible for cleaning, inspection, and repair.

"(2) It should be properly proportioned and so designed as to make it self-cleansing.

"(3) System should be properly trapped and ventilated. Each fixture should be provided with a trap.

"(4) System should be gas- and water-tight.

"(5) System should be free from movable mechanical devices which would be liable to get out of order.

"(6) Fixtures should be made of non-corrosive and non-absorbent material, and free from movable mechanical devices.

"(7) Fixtures should be located in well-ventilated and lighted rooms and should be set in the open.

"(8) An adequate supply of water to properly and thoroughly flush fixtures and drainage system should be provided." (C. A. Holmquist.)

In every well-planned institution the drainage system which carries the waste from the building into the sewer should be carefully planned. The pipes should be large enough to carry the combined waste from the fixture, the joints should be water- and gas-tight and there "should be a slope in the main house drain in the basement of about $\frac{1}{4}$ inch to the foot in order that the flow will produce self-cleansing velocities in it and keep it from becoming clogged. The main drain should be provided with a trap to prevent sewer-gas from entering the system, and each fixture, such as sink, water-closet, urinal, etc., should be provided with a trap to prevent sewer-gas from entering the rooms through the fixtures. Adequate provisions for ventilation should be made in systems of this type by carrying the soil and vent stacks through the roof of the house and providing the main drain with a fresh-air inlet."

"**Traps.**—Owing to the important part that traps play in plumbing systems the function and essential features of traps should be understood. As already noted, all

plumbing fixtures should be provided with traps in order to prevent sewer-gas from entering the rooms through the fixtures. The traps should be placed as near the fixtures as possible and they should be so located as to be readily accessible for cleaning. Traps in order to properly perform their function should be simple and durable; they should be self-cleansing and should not materially impede the flow through them. They should be so designed as to resist siphonage and back-pressure, and they should be free from movable mechanical devices that would be liable to get out of order.

"Although there are a great many kinds of traps, they may for convenience be divided into two general types:

(*a*) The siphon traps.

(*b*) The non- or antisiphon traps.

"*Siphon Traps.*—The simplest form of siphon trap is the running trap which consists of a downward bend in the pipe which when filled with water prevents the passage of air through the pipe. There are a number of forms of siphon traps, such as the D trap, the P trap, the S trap, including various modifications of them. These kinds of traps are not safe against siphonage unless properly back-vented, and should, therefore, not be used in the so-called one-pipe system of plumbing.

"*Non-siphon Traps.*—These traps are so constructed that the seal cannot be entirely destroyed under ordinary conditions, provided, however, that the soil stack is carried through the roof and a fresh-air inlet is provided. The principal objection to this type of trap is that it is not always self-cleansing due to the large body of the trap. They have an advantage in that they are not easily siphoned and the large volume of water in the trap is not quickly evaporated.

"Sewer-gas may also be admitted to a room through a fixture trap by back-pressure. This cannot occur, however, if the soil pipe is carried through the roof and if the house drain is provided with a fresh-air inlet to relieve the pressure that would be caused by the discharge of a column

of water into a soil or waste stack or by gusts of wind from the roof.

"*Grease Traps.*—In hotels, restaurants, and State Institutions where the wastes are rich in grease the sinks are usually provided with grease traps for the purpose of intercepting grease and preventing it from entering the drainage system and ultimately clogging it by the congealing of the grease on the sides of the pipes. The most efficient type is the so-called water-jacketed grease trap constructed with an outer compartment through which cold water circulates, causing the grease to congeal and rise to the top where it may be removed at regular intervals. The capacity of the grease trap is usually twice as great as the greatest amount of water that will be discharged into it at one time, so as to give the wastes time to cool and allow the grease to congeal before it reaches the waste pipe.

"**Refrigerator Wastes.**—Another class of wastes that should always receive special arrangement of piping is the refrigerator wastes. The waste pipe from a refrigerator in which foods are kept should never be connected directly with the waste or soil pipes, but should be discharged into an open sink provided with a trap in order to prevent sewer-gas from passing into the refrigerator if the trap should lose its seal due either to siphonage or evaporation." (C. A. Holmquist, in "Albany Medical Annals.")

Stoppage in the plumbing pipes is likely to be found in the trap, and the traps are so located, as a rule, as to be readily investigated. Very frequently grease obstruction can be quickly removed by flushing the pipes with boiling water to which concentrated lye has been added.

Snapping of plumbing pipes "is caused by excess pressure, lack of air chambers on the fixtures, or careless use of the valves. This snapping can usually be stopped by slightly and slowly opening and closing the nearest faucet."

General Care.—With ordinary care plumbing fixtures

which are properly installed should need no important repairs for several years. In hospitals, where the plumbing system is much more complicated than in an ordinary house, much of the trouble and expensive repair work is made necessary because of the carelessness of some nurse or servant. Dropping of articles into the bowl of the water-closet is a fruitful cause of plumbing bills. Much trouble and subsequent expense would be avoided if a nurse who accidentally dropped an insoluble substance or article into the closet would promptly report the accident and prevent the disastrous overflow.

Dirt has been defined as "matter out of place," but the conception of what constitutes dirt or filth is largely a relative one. The personal equation, training, and habits must enter largely into the definition with individuals. From a sanitary point of view, dirt may be said to be decomposing animal or vegetable matter and other matter involved with it. While this is matter on which the saprophytic germs are at work, effecting in it chemical changes, which will render it fit for use again in the scheme of vegetable life, it also furnishes conditions suitable for the life and development of disease germs, and there are, therefore, good reasons for the unceasing war with dirt.

Flies are now known to be active agents in the spread of germ diseases, and, therefore, another reason is found in the fact that decaying matter of any kind attracts and feeds flies. The fly, by crawling over contaminated matter, gathers to itself disease germs, later to deposit them on food to be carried into the body and thus continue the chain of infection. Because of their unceasing activities, flies are a far more dangerous kind of vermin than bedbugs in a house or hospital.

Rats and **mice** have been found to be important factors in spreading the bubonic plague.

Dust in a hospital may always be considered dangerous material. Under the microscope dust resolves itself into particles of soot, sand, iron and steel, glass, lime, woody fiber of vegetables—in fact, all manner of vege-

table matter, dried sputum, shreds of linen or wool from soiled bedding, pieces of hair, dried particles of pus, blood and human tissue, dried feces of horses, dogs, cats, and birds, crystals of urine, scales of skin, fragments of food of every sort, with disease germs of every kind. This is the material that floats in through the windows from the street to add to itself more disease germs from the centers of infection in the hospital wards; that is always floating in the air about us, though unnoticed; that settles on sterilized dressings and instruments as soon as they are exposed to the air; that mingles itself with the food; that is inhaled into the lungs of both sick and well if not properly and frequently removed; that is scattered over fruits, vegetables, candies, and other food wherever it is exposed for sale without covering. The nurse should need no argument to convince her of the relationship between dust and a great many forms of disease.

Infection of Food in a Hospital Ward.—A recent writer[1] on the subject of hygiene in hospital wards has called attention to what every one knows is a common condition. He says: "Every one is alarmed at once by the knowledge that a person who is coming into daily contact with a case of typhoid fever is working in the dairy from which a milk supply comes; but there is certainly no common concern over the fact that in a very large proportion of hospital wards the general milk supply of the ward is being constantly drawn upon by nurses who at various times soil their hands through caring for the mouths, the persons, the excretions, and the bedclothes of patients with typhoid fever, pneumonia, tuberculosis, and a variety of other infections." He mentions an instance in which a nurse had assigned as her chief duties the preparation of liquid diets and the disinfection of excreta and bedclothes. He believes that diarrhea and other complications and secondary infections

[1] Edsall, in *American Journal of Medical Sciences*.

occurring in typhoid fever in hospital patients are very frequently due to laxity or faulty hygienic methods. Whether or not this view is generally accepted, there is every reason why nurses should observe extreme care in their management of these duties, lest by any act of carelessness on their part any patient may be adversely affected.

Sources of Infection.—In a large number of diseases the infectious matter is thrown off in the discharges from the throat and nose, while vomited matter in many cases, bowel discharges, urine, pus, and other discharges from wounds are capable of causing serious trouble if not carefully handled and promptly destroyed.

Care of Ward Utensils.—The care of ward utensils and appliances, especially those used by patients having an infectious disease, is a matter of great importance in a hospital. Methods may vary according to facilities, but a nurse cannot too early learn that she has it in her power to do untold harm by simply being careless about what she may consider little things.

Boiling of vaginal and rectal nozzles, catheters and tubes, sputum-cups, basins and instruments used about wounds, of syringes, etc., will always render such articles safe. An increasing number of hospitals are providing in hospital bath or service rooms facilities for boiling bed-pans and urinals also. Isolation of drinking glasses, dishes, and basins used by patients having communicable diseases should be carefully observed. Rubber sheets and pads can be subjected to thorough cleansing and chemical disinfection. Soap and water regularly and faithfully applied will keep shelves, racks, and service rooms in a sanitary condition.

Bed and *body linen* from infectious patients can be subjected to chemical disinfection and, later, boiled as a part of the cleansing process.

A solution that is highly recommended for the disinfection of bed linen and clothing contains the following:

Carbolic acid	3 parts.
Common soft soap	$1\frac{1}{2}$ "
Water	100 "

The clothing should remain in the solution not less than one hour, and whenever possible the solution should be hot when applied.

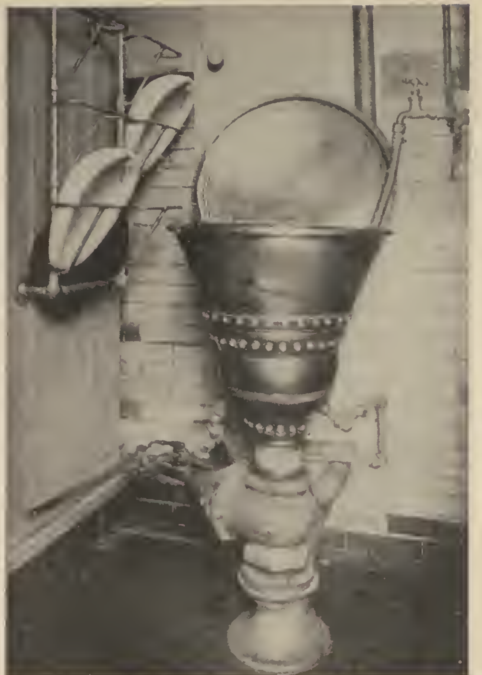
To summarize: In a hospital ward infection may be communicated from one patient to another by the nurse through food; through the air by means of dust; through the hands of nurses and other attendants; through thermometers, dishes, instruments, basins, or other utensils used in common.

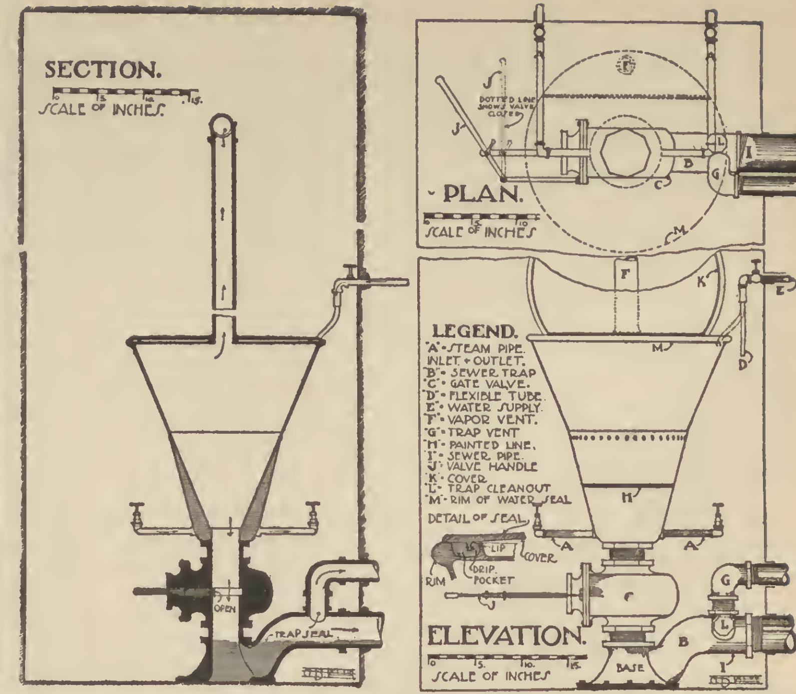
Cremation of all garbage, soiled dressings, and refuse is the safest of all means of disposing of it. Whenever possible, utensils used for collecting such refuse should be exposed to live steam. If this is not available, careful daily cleansing and chemical disinfection should be practised.

Sinks may be kept in a sanitary condition by observing thorough general cleanliness every day. In order to prevent pipes becoming clogged with grease, copious flushing at frequent intervals with a strong solution made of lye or soda carbonate with boiling water should be practised. Plenty of soap and boiling water act as disinfectants, and if faithfully and freely used, other disinfectants will rarely be needed.

Chlorinated lime (popularly termed *chlorid of lime*) is a powerful deodorant and is useful for disinfecting hoppers, waterclosets, and such places. It should be used hot when possible and a strength of 4 per cent. is recommended by expert disinfectors. A solution of 1 per cent. by weight has been proved to disinfect typhoid stools in ten minutes. It is very essential that the lime used should be fresh. A test of the freshness of the substance is the clearness of the solution. Chlorin is the active agent in disinfecting, and when the chlorin is lost, the solution will be of a milky color.

Labarraque's solution is a combination of soda car-





Sterilizing hopper for the safe disposal of infectious excreta in hospitals. When infectious discharges are to be sterilized the gate valve is closed. Through the rubber hose at the right water is turned on for washing of utensils, and is allowed to enter the hopper to the line H. Steam is then turned on through the steam inlet. Boiling takes place almost immediately, and after five minutes' boiling the gate valve is opened to allow the contents to escape and the hopper is flushed by means of the hose attached to the faucet.

bonate and chlorinated lime. It removes stains from glass and is often useful in cleansing and disinfecting glass appliances and bath-room utensils.

Floors of bath-rooms or of any room in which infectious substances are contained, carried about, or disposed of should be given careful attention. Either bichlorid of mercury (1 : 1000) or carbolic acid (5 per cent.), applied hot, will render them sanitary. Thorough scrubbing with a hot solution of lye and water, or one in which soda carbonate is freely used, is sufficient for ordinary cleansing.

Carpets or *rugs* which have become contaminated with infectious discharges in a sick room, may be disinfected by wetting with a 5 per cent. solution of formalin and the room kept closed for twenty-four hours. If these are to be subjected to the action of formaldehyd gas in the general disinfection of the room, the infected stains should be saturated with formaldehyd before the gas for general fumigation is evolved.

Destruction of Insects and Vermin.—Kerosene is valuable as a means of preventing and destroying roaches and other forms of insect vermin, notably mosquitoes. The pure oil is used by spraying or as an emulsion with soap and water. The best means of preventing trouble from ants, roaches, and such insects is to observe thorough cleanliness around sinks, pantries, and such places, and leave nothing about that will attract them. Prevention is always easier than cure in such matters.

Sulphur fumigation is recommended by Rosenau for the destruction of roaches, bedbugs, mosquitoes, flies, fleas, and all kinds of vermin, including rats and mice. The fumes must be very strong. The same strength and general precautions recommended for bacterial disinfection with sulphur should be used.

CHAPTER XXI

PERSONAL HYGIENE

Personal hygiene concerns itself more particularly with the habits of the individual as regards his care of his own body. The subject of how to keep well is one which nurses should study much more than they do, for the matter is one which they can very largely control. A great deal of the minor sickness that occurs among nurses is clearly preventable. It is largely due to indiscretions in matters of diet or clothing, or to carelessness which in others they would quickly condemn.

Hygiene of the Digestive System.—Only a few general suggestions can here be given. The subject will bear study throughout the greater part of life, for in the matter of digestion and digestive disorders the personal equation should be considered in every case.

1. Masticate food thoroughly. Imperfect chewing of food is the cause of a large proportion of digestive disorders. It is a habit or condition that is notoriously common in hospitals and among nurses. Food which reaches the stomach in a coarse, unmasticated condition throws extra burdens on the stomach, as full digestion cannot take place until the fibers of food are disintegrated, so that every part may come in contact with the digestive juices. It means also that the food has not remained long enough in the mouth for a sufficient amount of saliva to be mingled with it for perfect digestion. Food which is forced in this condition into the stomach often acts as a mechanical irritant to the delicate mucous membrane, causing gastric catarrh.

2. Avoid eating too frequently. The pernicious habit of nibbling at popcorn, candy, cake, bananas, etc., cannot be too strongly condemned. Too frequent eating means overwork for the stomach; no time is allowed in which it may rest. Being composed largely of muscles, it becomes weary from constant exercise and soon is unable

to do its work properly. Late suppers usually mean disturbed sleep. During sleep there is a slowing of all the vital functions and digestion is retarded. In consequence of delay, chemical changes take place in the food. Certain acids and gases are developed, which act as irritants to the lining of the stomach. Accumulation of these gases results in distention of the stomach, pressure on other organs, and in time weakening of the stomach walls result. Bedtime meals should at least be of light and easily digested food.

3. Avoid taking too much fluid at meal time. Excess of fluid dilutes the gastric juice and retards its action.

4. Avoid taking too much frozen food or iced drink, and when used take it slowly. Digestion requires a temperature of about 100° F.

5. Avoid foods that are known to disagree. There are comparatively few individuals who can use all foods without inconvenience.

6. Avoid overloading the stomach. Overeating is the cause of many disorders. It not only overtaxes the digestive organs, but the organs of elimination, especially the liver and kidneys, are injured by being forced to deal with an overwhelming amount of waste matter. So-called "bilious attacks" are frequently induced by overeating, too rich food, or too much coffee. A well-known medical writer stated a fact tersely when he said "The liver acts like a wise horse when overloaded—simply stands still until part of its burden is removed." Another writer, speaking of overeating, says, "The surplus fund of nutrient material unused is stored up in some form. When a certain amount has been thus disposed of, an undesirable balance remains against the feeder, and, in young people, is mostly rectified by a 'bilious attack.'"

7. Endeavor, as far as possible, to have meals well balanced, providing for a proper amount of nutritive elements and avoiding an excess of any one element.

8. Avoid the use of too much fat in food. Fat, in

excess, is apt to retard gastric digestion by coating the food so that the juices cannot penetrate.

9. See that starchy foods are thoroughly cooked. Insufficient cooking of foods containing starch is a common cause of digestive disorder.

10. Avoid eating a heavy meal when overtired or worried. In either case the secretion of digestive fluids is likely to be deficient in quality and quantity for good digestion.

Hygiene of the Mouth and Teeth.—The care of the teeth and oral cavity is especially important for nurses who are constantly exposed to infection from various sources.

Dental caries is so common that its possible effects on the general health are often overlooked. In this condition the enamel and dentin of the teeth are dissolved and disintegrated by the action of acid-producing bacteria and their products. Infection from the teeth is carried in food and drink to other parts of the body, and often gives rise to a train of disturbances that is serious in its effects in the individual concerned.

The tonsils have been made the subject of extensive research in recent years. While their function is still not clearly understood, it is believed by many that they serve as a filter to some extent, and assist in protecting the body against the entrance of harmful bacteria.

Diseased tonsils are a source of danger to the body in various ways. Recent investigations into the causes of rheumatism (so-called) and certain forms of heart trouble tend to the belief that the infectious agent causing the trouble was first deposited in the tonsils, and that the general infection followed slowly and insidiously, but none the less surely. The injurious effects of diseased and enlarged tonsils on the ear and the hearing of the individual are now fairly well understood. Prevention of all these troubles is much easier than cure.

Hygiene of the Skin.—The health of the skin is largely dependent on three things: proper diet, exercise,

and regular bathing. The skin is a most complex organ —one of the great safety-valves of the system. When an internal organ fails to do its work, the skin often attempts to compensate by extra exertion. A daily sponge-bath is within reach of most people and is a good habit to form. The face and neck, being constantly exposed to dust, need more frequent cleansing. The feet should have, whenever possible, at least one cleansing each day. The axilla, because of the detention of secretions, needs at least a daily washing, while the hands and arms will need many. In the study of physiology it was shown how the outer layer of skin is always being rubbed off by friction. Besides the fluid which exudes from the pores in the form of perspiration there is a considerable amount of solid matter excreted daily by the skin. This, with the dust from the atmosphere, soon forms a crust which blocks the pores and interferes with the functions of the skin if not removed.

Baths for ordinary cleanliness should be suited to the season of the year and the inclinations of the individual, so far as temperature is concerned. The tonic effects of a cold sponge, spray, or plunge bath are well known, but these should not be used indiscriminately. If time for bathing is limited in the morning, a wet towel quickly applied followed by a brisk rub with a dry coarse one is a good substitute. In fact it is a good plan when in health to follow all cleansing or tonic baths with friction of some kind.

The best time for a bath is just previous to a meal or from two to three hours after. During digestion the stomach needs an extra supply of blood. If by means of a bath the blood is drawn from the stomach to the superficial parts of the body, digestion is sure to be retarded.

Hygiene of the Respiratory System.—The natural entrance to the air-passages is the nose, which is so constructed as to act as a filter to the air, preventing the entrance of dust and moistening and warming the air.

Any obstruction to the nasal passages makes mouth breathing a necessity. As the mouth offers no obstruction to the entrance of dust with the air, it follows that mouth-breathers are especially prone to diseases carried by means of the air, such as influenza, tuberculosis, pneumonia, etc.

Colds in the head are usually due to a combination of causes. Those who live in a superheated atmosphere and accustom themselves to excessive clothing lower their resistive power and are especially liable to catarrhal affections of the air-passages. Other causes are prolonged exposure to cold or dampness, sudden chilling of the body, impure air, and bacterial infection. The habits of the individual will determine in large measure his ability to resist this affection. A generally clogged-up system predisposes to colds, and very slight causes are needed to produce an active congestion. Sleeping in unventilated rooms is another condition that tends to susceptibility in this direction. Those who wilfully shut out fresh air and refuse to admit the oxygen that Nature has provided must expect to suffer more or less from respiratory ailments. The idea that night air is unwholesome is erroneous. Certainly in cities the night air is purer, freer from dust than during the day.

Compression of the chest by improper clothing plays its part in inducing weakened lungs. The practise of deep breathing, especially when in the open air, helps to increase chest expansion. Modern physicians are laying more and more stress on proper methods of breathing as important aids not only in the prevention of tuberculosis and other disease of the air-passages, but in maintaining general health. The proper management of the body when in an overheated condition is a subject of which a great many individuals know good general hygienic rules which they do not practise. It is not uncommon to see an intelligent woman while overheated and in a state of active perspiration rush immediately out into the cool air. A common example is that of the woman

who has become overheated by washing in a warm room, the atmosphere of which is saturated with steam, who rushes out dripping with perspiration into a freezing atmosphere to hang the clothes on the line. Quite as frequently one may see a man who has become overheated by extra exertion, throw off his overcoat, take a drink of ice-water, sit down in a draught to cool off, or go at once to the table and indulge in a full meal while in an overheated, exhausted condition. The same man, if his horse is perspiring freely, will at once give orders that it must not be fed a full meal, must not be allowed to drink freely of cold water, must be blanketed until dry, or at least must be allowed to cool off gradually. The observance of these simple hygienic rules which are generally regarded in the care of horses would, if always applied to individuals, prevent much discomfort. These are homely illustrations of hygienic blunders, but any observing nurse must admit that they are true to life. If nurses are to become, in deed and in truth, teachers of hygiene, instructors of those with whom they come into contact in better methods of living, they should themselves practise such methods till good hygienic habits have become second nature.

CHAPTER XXII

PERSONAL HYGIENE (*Continued*)

Hygiene of the Hands.—The care of the hands is one of the most important of all hygienic considerations to nurses. Through them she may most easily herself become infected or carry infection to others. Any break in the surface of the skin is an avenue by which disease germs may gain entrance. One of the first lessons a nurse should learn and practise till the habit becomes deeply rooted is to avoid handling with the fingers soiled dressings or materials of any kind saturated with a discharge that contains disease-producing germs.

Every nurse should carry with her constantly her own thumb forceps, for use, as far as possible, in handling such matter. When in attendance on a patient suffering from a communicable disease a basin of disinfectant solution should be kept in a convenient place for frequent immersion of the hands. Under the finger-nails is a favorite lurking place for germs, and it hardly needs to be stated that the nails should receive careful attention in the cleansing. It is a much better practise for a nurse to keep her hands in good condition, finger-nails trimmed short, and to form the habit of frequent scrubbing with soap and water, than to depend on dipping the hands for a moment now and then into a disinfectant solution, though the latter is necessary at times. Real disinfection of the hands is not accomplished by momentary contact with a disinfectant solution.

Careful cleansing of the hands before meals or before partaking of food of any kind is a rule that cannot be too closely observed.

Carelessness regarding this point is one of the very frequent causes of typhoid fever. The germs are on the hands and are conveyed with food into the alimentary tract. There is no question also that when a clean wound becomes infected, the cause, in probably the majority of cases, is due to contact infection resulting from imperfect cleansing of the hands. As a matter of general daily care, some good hand lotion should be used to keep the skin soft and free from cracks or irritation. It is the height of folly to use disinfectant solutions on the hands till the skin becomes a mass of cracks, each of which becomes a channel for the entrance of infectious germs, and to perpetrate this piece of folly in the name either of hygiene or asepsis.

The **general care of the feet** should include, first, cleanliness; second, suitably warm stockings; third, properly fitting shoes with broad heels; fourth, dryness of shoes and stockings. The French heel, placed near the middle of the foot, is an anatomic abomination which

makes walking exceedingly difficult and tiresome, besides conducing to weakness of the arch of the foot through atrophy of the ligaments which hold the foot in position.

Where there is excessive perspiration of the feet, daily cleansing and change of stockings should be observed. There are few if any other articles of clothing which affect the comfort as much as shoes. No individual can expect to bring to her work the maximum of alertness and energy who is suffering from painful feet or badly fitting shoes.

Hygiene of the Eye.—The health of the eye is closely connected with the general health. Anything that seriously affects the general health, producing an exhausting drain on the system, will affect the strength of the eye, in common with other organs. The eye is intimately related to the nervous system and defects in it will not only affect other organs through the nervous system, but the eye will in turn be affected by derangement of the nervous system.

The eye is probably the most overworked and abused organ of the body. When the other muscles of the body are exhausted, the eye is still forced to keep at work, and often under very difficult conditions. If the eyes have been carefully guarded from injury from any cause during infancy and childhood, the observance of the following general hygienic precautions should be sufficient to keep them in normal condition:

1. When reading, writing, or sewing see that there is sufficient light. Reading in a dim light or doing any work which makes great demands on the eyes is quite sufficient, if continued for any considerable time, to cause serious eye disturbance. The best position in reading is the upright, leaning slightly backward with the head erect, and the book nearly on a level with the eyes. With the head held erect there is less liability to ocular congestion. No type should be used that is not legible at 20 inches from the eye.

2. The light should be on a level with the top of the

head and should, whenever possible, be arranged so as to fall from behind over the left shoulder.

3. Reading when lying down should be avoided, and is particularly dangerous during convalescence from illness or when physically tired. In reading when lying down or in constant looking upward there is a tremendous strain on some of the muscles of the eye, which may in time result in permanent impairment.

4. Reading in street or railway cars is better not indulged in. If attempted at all, the eyes should be relieved by frequent rests.

5. Sewing or embroidery require the most trying ocular labor and the best conditions of illumination, and any individual who is conscious of eye defects should spend as little time as possible in these employments.

Continual excessive lacrimation or "watering of the eyes" may be due to the constant presence in the atmosphere of vapor or dust, such as exists in manufactories of flour and various industrial works where there is much grinding of metals. It may also be due to excessive smoking, to inflammation of the lining of the lid (conjunctivitis), or to eye strain from excessive use of the eyes or working in a dim light. The symptoms of eye strain are very numerous. In many cases the difficulty is readily corrected by proper glasses, and it is best to consult a reliable oculist when, for any reason, the eye directs attention to itself because of pain or defective vision. If a child is irritable, complains of headache, squints, holds his book close to his face, or seems uncomfortable at his studies, there is sufficient reason for a skilled examination of the eye.

Sleep.—An important part of Nature's plan for the repair of the waste of the tissues of the body that constantly goes on is in provision for sleep. During sleep there is a lessening of the activity of the vital machinery of the body and the tissues are able to regain their lost tone and vigor. In adult life from seven to eight hours out of each twenty-four should be spent in sleep, and

during the years of rapid growth in childhood from ten to twelve or more hours each day may wisely be spent in sleep. Quietness, darkness, a cool room, plenty of fresh air, a bed moderately hard, and covering light but sufficiently warm, are conditions favorable to sleep. Where there is any tendency to wakefulness, mental activity should be guarded against, as far as possible, in the late afternoon and evening. Tea or coffee should not be indulged in for the evening meal. A light meal at bedtime is conducive to sleep. By this means there is an increase in the blood supply in the organs of digestion and a lessening of the supply of blood sent to the brain.

Rest and **recreation** are essential to health, but the methods used in securing these are often a source of exhaustion rather than of recreation. The real meaning of recreation is to refresh, to give fresh life to, or to create anew. Anything which contributes to the joy of living, without detracting from the capacity for work, may be termed a recreation. Anything which leaves an individual less able to meet the demands of the coming day is a doubtful form of recreation to indulge in. In any active career and, certainly, in a nurse's career, the first asset is an alert mind in a healthy body, and those who would keep at their maximum must learn to regulate wisely their habit of sleeping, of recreation and rest, of eating, and general living. They must bring as much intelligence to bear on maintaining their capacity for work as they do on the work itself. The term overwork is very freely used as a reason for a physical break-down, but work alone rarely causes physical degeneration if the conditions under which it is pursued are sanitary and wholesome. Worry is probably much more frequently the cause than overwork, and very often unwholesome methods of recreation, unwise feeding, and too little sleep are concerned in serious physical collapse.

Clothing.—The question of clothing is one on which much might be said. Each of the four materials—cotton, wool, silk, and linen—has its advocates as regards under-

clothing. The material used makes little difference to health, providing it is clean, sufficiently warm to protect, and generally comfortable. Three principal errors in clothing should be avoided by women who have any regard for the principles of hygiene:

1. Having the skirts so long that they trail on the ground and gather to themselves the filth of the street.
2. Wearing skirts so heavy that they drag on the pelvic organs.
3. Wearing corsets that constrict and compress the chest and abdomen. The two latter errors in clothing are said to be responsible for much of the downward displacement of the stomach, intestines, kidneys, liver, and pelvic organs that is so common among women, and that carries in its train a great many disorders.

A very common blunder is made by women in discarding heavy underclothing and donning thin gauze underwear, lace waists, or other thin materials in severely cold weather, in order to appear to better advantage. In the clothing of children almost any day on the street may be noticed a lack of common sense or ignorance of the first principles of hygienic dressing. One example is that of a child dressed with short socks extending but little beyond the shoe tops, legs bare to the knees, while the remainder of the body is wrapped in wool and furs. Another extreme is often reached by ignorant mothers who burden their babies with an excess of heavy body and bedclothing, till the little one sinks beneath the exhausting burden and the conditions resulting from it.

Carriage.—Faulty methods in standing or walking are responsible for not only an ungainly figure, but for some of the derangements of functions of the organs of the chest and abdomen. The erect position in sitting, standing, and walking, the throwing of the shoulders back to give full play to the chest, should be practised till it is a habit.

General Considerations.—All classes of workers need mental recreation—not only a change of scene, but

a change from the subject with which the brain is usually busy. Any brain that is forced to keep working in a single rut not only fails of its full all-round development, but is more likely to quickly exhaust its own forces. There is, therefore, a physical as well as a moral reason why nurses should train themselves to avoid bringing, as subjects of conversation, the patients or the incidents connected with their work to the table at mealtime, or out with them when they go on the street.

The sun is one of Nature's great regenerative forces, and a certain amount of exercise in the open air and sunshine is necessary if vigorous health is to be maintained.

Most forms of labor require that certain muscles and parts of the body get more exercise than other parts. With nurses the muscles called into play in walking usually get plenty of exercise, while other parts of the body get little. It does not require a stated hour or a special class in gymnastic exercise to secure exercise for all the muscles of the body. Any nurse who desires can take advantage of body-building exercises. Some form of recreation involving active exercise in the open air is especially desirable when it can be secured.

"We should seek such vital capacity, such adjustment of all the parts, as will best sustain the whole. Many a person loses health because there is a defect in one vital part when all the rest of the system is in good condition. Where we cannot fully repair or bring an individual up to a higher standard of health, we can study the type of the individual and bring him up to a higher standard of comfort and vigor. We can use the resources we have to acquire more. All do not begin with the same capital of health or even acquire it, but they can at least learn what their capacity is, how to preserve and increase it, and live accordingly" (Hatfield).

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SECTION IV

BACTERIOLOGY

CHAPTER XXIII

BACTERIOLOGY

Historical Notes.—The story of the development of bacteriology is the story of devoted, painstaking experiment and research on the part of physicians and other scientists, extending over hundreds of years.

Nursing and Bacteriology.—The development of the science and art of modern nursing is so closely allied with the history of the developments in bacteriology in the last half century that all nurses should become familiar with the outstanding features in the progress in bacteriology. We are debtors not only to Florence Nightingale and her associates who laid the foundations for nurse training, but debtors more than we can ever realize to the labors of the noted men whose research in the realm of bacteriology has revolutionized the practice both of medicine and surgery, and exerted a corresponding influence on nursing methods.

The *history of bacteriology* carries us back at least into the seventeenth century, and many writers claim that several centuries previous there were unheeded announcements of the discovery of "invisible creatures" which were believed to have caused various diseases.

Leeuwenhoek.—In the seventeenth century a native of Holland, named Leeuwenhoek, succeeded, by means of a special lens which he had perfected, in finding what were then termed "animalcules" in water, which he declared lived and moved and multiplied. It was many years

later that the connection between these animalcules and communicable diseases began to receive serious consideration. Whether these living organisms, which seemed to be associated with epidemics of disease, were the result or the cause of the disease was for many years a hotly disputed question.

Plenciz, of Vienna, in 1762, after much study and experiment, asserted his belief that each of the communicable diseases was caused by a living germ or microbe which multiplied in the system, which could be thrown off by the sick and which could be carried by the air to others and cause them to contract the disease. The scientific world of his day did not accept his theories as proven, and little progress was made until the second quarter of the nineteenth century was well advanced.

General Conditions.—Meanwhile epidemics of communicable diseases were woefully frequent, and whole communities were swept with disease as with a devastating fire. Hospital gangrene, suppuration, puerperal sepsis, and other forms of sepsis, were every-day occurrences in hospitals and homes. Inasmuch as nothing definite was known or regarded as proven as to the relation of germs to surgical conditions, no precautions were taken to prevent the infection of wounds. Disinfectants, as such, and sterilization were unknown in hospitals. Surgeons wore the same blood-stained broadcloth or wool coat at all their operations, and were proud of the blood-stains which dated back months or years. Sponges were used commonly for the swabbing of wounds of all classes and kinds and for different patients, and so infection was carried from one patient to another. Water was used without being boiled in surgery, and dressings were packed on shelves or in drawers without any outside covering to keep the dust from settling on them.

Medical students went from the dissecting or autopsy rooms to assist at births without even the formality of washing the hands being observed in many cases. The

death-rate from puerperal sepsis in hospitals was appalling. Meanwhile experiments in different parts of the world were being carried on, and scientists of many countries were making their contributions to the founding of the science of bacteriology.

Semmelweis, a Hungarian, who was studying in Vienna, announced to the world in 1847 that puerperal sepsis was due to the entrance of germs into the genital tract introduced by the hands or in other ways. He noticed that the midwives had fewer cases of puerperal sepsis than did the medical students, and ascribed as one of the chief reasons that the medical students went directly from the dissecting room to the birth chamber without proper cleansing of their hands. In his own practice he began to insist on the rigid cleaning of the hands before approaching a lying-in woman, and the good results were soon apparent in the marked decrease of cases of puerperal sepsis. His fellow-scientists, however, remained skeptical, and his theories were ridiculed and rejected for many years. He died before he saw his theories and methods generally accepted. Improvement in obstetric methods, however slow in gaining ground, had actually started before he died and dated from his experiments. Here and there physicians began to adopt his methods and childbirth became less perilous.

Pasteur.—Three names will always stand out with brilliant luster wherever the history of bacteriology is known —Pasteur, of France, Lister, of England, and Koch, of Germany. Louis Pasteur was born in 1822 and died in 1895. He lived to see the results of his research accepted and put in practice throughout the civilized world. His experiments in regard to how germs are spread began in 1862. While he was not the first to prove the existence of germs, nor the first to show their power to cause disease, his experiments settled a great many of the disputed points and laid sound foundations for future work in bacteriology. Accepting as true the assertions of his predecessors in

bacteriologic research that germs are the cause of many diseases and may be carried by the air, he demonstrated through a series of experiments that "the development of putrefaction took place not from the gaseous elements of the air but from particles suspended in the air and which fell from the air in a vertical direction. He showed that a fluid which was sterile when placed in a flask with a long neck laid sideways did not undergo putrefaction until the neck was allowed to stand upright and open to the air. He showed that germs did not develop spontaneously in the body as many claimed, but that growth and reproduction took place from microörganisms which were floating in the atmosphere. He claimed, and proved his claims, that germs are always in the air, in water, on the hands and the body generally, on surgical dressings and instruments, and by a long series of experiments on the development of fermentation and putrefaction, particularly in regard to the wine and silkworm industry in France, he was able to prove his statement to the satisfaction of scientists in general.

Lister, of England, a surgeon who had studied the work of Pasteur carefully, was the first to apply the theory that if germs are always in the air, on our hands and bodies, on dressings, etc., that their entrance into a wound might be the cause of suppuration, and that it might be highly advantageous to use some antiseptic or germicidal agent to kill the germs before they got a chance to enter a wound. Accordingly, he proceeded to try the effect of spraying with a carbolic acid solution all around the field of operation. Dressings were saturated with the carbolic acid solution. As was the case with Semmelweis, the beneficial results of trying to keep germs from entering a wound were immediately apparent in the wounds treated, and the era of antiseptic surgery began. After some years of experimenting with antiseptics, it was found that by subjecting dressings and other articles to steam sterilization and keeping them protected from the air or from

handling with unsterile hands as good results or better were secured than with the liberal use of antiseptics which was so common in the years following Lister's discovery.

Lister's work was contemporaneous with that of Florence Nightingale, and exerted a tremendous influence in promoting the establishing of training-schools, in order to provide nurses who knew how to carry out the surgical technic which he inaugurated and which was speedily adopted all over the world. Lister first published his antiseptic theory in 1867.

Robert Koch, of Germany, the third of the brilliant trio whose names are associated with the history of bacteriology in the last half century was another who built on the foundations established by Pasteur, in regard to germs as the cause of disease. He, for the first time, showed that it is possible to isolate the organisms in pure culture, to cultivate them indefinitely, to reproduce the conditions by inoculations of these cultures into susceptible animals, and to continue the disease at will by continuous inoculations from an infected to a healthy animal.

Koch's circuit or Koch's law in regard to germ diseases is still accepted. Briefly it is as follows:

1. The germ must always be found where the disease is present.

2. It must be capable of development in proper culture-media outside the body.

3. These cultures must be capable of producing the disease in a healthy animal.

4. The same germ must be found in the inoculated animal.

5. It must be further shown that no other form of micro-organism is capable of producing the disease, and that where the original form of bacteria is not obtainable the existence of the disease is impossible. Koch, however, will always be best remembered by nurses as the discoverer of the tuberculosis germ which paved the way for the modern crusade against that disease.

Once the foundation principles were established, discoveries of different germs followed thick and fast. (See pp. 233–237.) In dealing with germ diseases we are no longer fighting an unknown enemy in the dark, but dealing with an enemy whose habits are well known. We know the conditions under which bacteria flourish, how they gain entrance to the body, how they are transmitted from the sick to the well in most diseases. We know that the germs of disease can be cultivated just as surely as can roses in the garden, and equally well how they may be destroyed.

Bacteriology is defined as that branch of science which has for its object the study of microörganisms or bacteria.

Bacteria is the general term used to denote the large group of microörganisms of different classes. Formerly known as animalculæ, they are also popularly called microbes or germs. They are the lowest form of vegetable life and are essential to animal and plant life. Bacteria reproduce themselves in two ways: by fission and by the formation of spores.

Fission means the division of the germ into various segments or pieces, which soon dissolve partnership with the parent cell and, in turn, similarly divide and multiply, as long as conditions are favorable.

Spore Formation.—Spores of bacteria correspond to the seeds of plants or grains. When a spore or seed is about to be developed, changes take place in the germ. Irregular points appear and a capsule is formed around the spore. Eventually the parent germ disappears, leaving the spore free. By this process bacteria enter into a state in which they resist deleterious influences, such as heat or cold, to a much greater degree than is possible in the growing condition. This is also true of plants which produce grains, the seeds retaining their power to germinate indefinitely, while the life of the plant which produced the seed is comparatively short lived

and quickly destroyed by frost or other adverse conditions.

The most wonderful thing about bacteria is their power of multiplication. Given favorable conditions, one microbe will multiply itself by millions in a day. Their rate of development is, however, often cut short by the toxins or poisons they produce.

Requirements for Growth.—Bacteria always require warmth, suitable soil in which to grow, and suitable food. Germs are quite as exacting in their requirements as hothouse plants, so far as surroundings are concerned. A germ of tuberculosis might be expectorated on the floor. It would not multiply on that location, just as a kernel of wheat would not germinate under those conditions, because the warmth, moisture, and nourishment

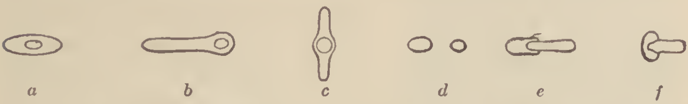

FIG. 93.—Diagram illustrating sporulation: *a*, Bacillus enclosing a small oval spore; *b*, drumstick bacillus, with spore at the end; *c*, clostridium; *d*, free spores; *e*, and *f*, bacilli escaping from spores (McFarland).

it needed were lacking. It might, however, retain its vitality for some time, and when dry and stirred up in the air would be ready to reproduce itself, as soon as it gained entrance to a body which presented favorable conditions.

Classification of Bacteria.—The two great classes of bacteria are the saprophytes and parasites, as mentioned in the lessons in hygiene.

Saprophytes are germs which derive their nutrition from dead animal or vegetable matter.

Parasites are germs which live always at the expense of some other living creature. Their activity results in a tearing down and weakening of the part to which they are admitted.

Decomposition, fermentation, and **putrefaction** are the work of the saprophytes. Through their activities,

dead animal and vegetable products are changed into carbonic acid, water, ammonia, and other elements which go to fertilize the earth and serve as nourishment for vegetable life.

In the industrial world the saprophytes do an equally important work in their action on hemp fibers, leather, wines, vinegar, etc. It is said that germs play an exceedingly important part in the growth of tobacco; different germs producing different flavors in the same plant. Their activity in producing changes in milk by the formation of certain acids is well known. Other forms of bacteria produce chemical changes in butter and cheese. As all germs require warmth in order to do their work, the keeping of these substances in a cool place, at a low temperature, prevents the work of the germs which cause milk to become sour.

The work of the fungus germs is clearly shown in the autumn when every leaf on the tree has multitudes of these low vegetable organisms at work on it, producing the variety of coloring which precedes the return of the leaf to form a part of the soil on which it falls. The activity of the yeast germs is well illustrated in bread making. In many respects there is a close analogy between their methods of work and those of the disease-producing bacteria. Both require warmth, moisture, and a suitable soil that will afford material for growth and development. A certain time elapses before the chemical changes in bread materials become manifest. There also comes a time when such changes are produced in the substances as render them incapable of being further acted upon by the yeasts—a condition analogous to that produced in the body by many of the germs of infectious fevers. Their activity is self-limited.

Classification According to Shape.—Bacteria are frequently classified according to their shape, outline, and structure into three main groups (with their subdivisions): spheres, rods, and spirals. The spheric forms, or those which are practically the same diameter

when viewed from any point, are named cocci or micrococci. (The prefix "micro" means very small, minute, infinitesimal, etc.)

The rod-shaped or oval are termed bacilli, and those twisted, spirilla.

Cultivation Outside the Body.—Bacteria are cultivated outside the body by means of culture-media and a suitable apparatus. The media is the material used for cultivating the germs. The most common substances used as media are beef-tea or bouillon, to which gelatin is sometimes added; potato; milk; and blood-serum. The bouillon, with either animal or vegetable gelatin, is the substance most frequently employed. A germ incubator or some method of providing warmth is necessary.

FIG. 94.—Bacillus tuberculosis; glycerin agar-agar culture, several months old (Curtis).

Mode of Grouping.—The cocci or micrococci are subdivided according to their prevailing method of grouping, as seen in growing cultures. Those growing in masses like clusters of grapes are named staphylococci; those in chains, streptococci; those in pairs, diplococci; those developing in fours, tetrads; those dividing into eights, as in cubes, sarcinæ.

Bacilli may be subdivided into two main classes: spore-forming and non-spore-forming bacilli.

General Considerations.—The practical things which are especially important for nurses to remember about bacteria are:

1. That both good and bad germs are to be found

practically everywhere—in the air, in water, in the upper layers of the earth, on the surface of the body, and in

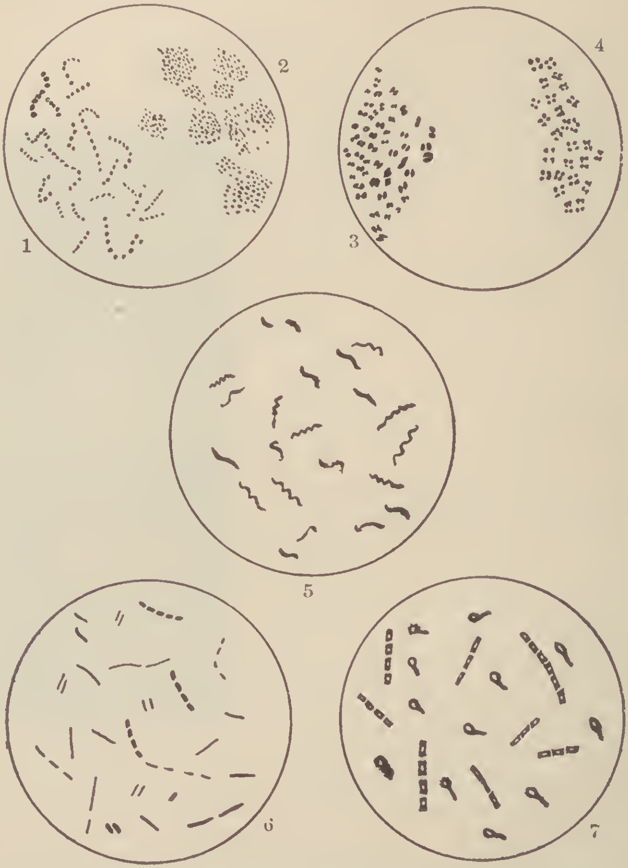

Fig. 95.—Various forms of microörganisms: 1, Streptococci; 2, staphylococci; 3, diplococci; 4, tetracocci; 5, spirilla; 6, bacilli; 7, bacilli with spores (Paul).

the alimentary tract. They are not found in the deeper tissues of the body.

2. That for their growth and multiplication it is

necessary for them to fall on a suitable soil with suitable surrounding conditions.

3. That a large number of these low forms of life, called microörganisms, are helpful rather than hurtful to the human system.

4. That disease-producing germs are capable of independent life without the body.

5. That for the occurrence of germ diseases two factors are necessary—the individual must be in a susceptible condition and there must be the inciting cause or agent.

6. That without the entrance of these germs to the body the large number of medical and surgical diseases commonly classed as infectious could not take place.

CHAPTER XXIV

INFECTION AND IMMUNITY

Infection is the process by which germs produce disease.

The term "contagious" is applied to diseases that are acquired by direct contact with one afflicted with the disease.

The terms infectious and contagious are rapidly being discarded as inaccurate or at least confusing. Formerly, the term infectious was applied to diseases in which the germs were either air or water borne, but no such distinction between contagious and infectious holds good to-day. So-called infectious diseases are found to be transmitted by inoculation, and diseases formerly classed as contagious are carried by means of air or water. In fact, most of such diseases are communicated in a variety of ways.

The term *communicable disease* is preferable. It signifies a disease which is capable of being communicated from one person to another without attempting to signify the mode of communication.

The term *specific*, as applied to diseases, simply signifies that the disease resulted from a preëxistent case of the same disease, through the agency of a special or specific germ peculiar to that disease, and found in no other disease.

Entrance to the Body.—Pathogenic or disease-producing bacteria enter the body through the alimentary canal, the air-passages, the genital system, the mucous membranes, wounds, and the skin. In each specific disease the contagion multiplies, chiefly in some part of the mucous membrane or the skin, each germ having its special location, called the seat of the invasion. The infectious matter in large measure is cast off in the secretions coming from the seat of the disease. Once outside the body, the infectious matter may remain dormant in clothing or sick-room furnishings for long periods, still retaining its power to infect if given suitable conditions. A great many of the more common disease germs are promptly destroyed by exposure to oxygen and direct sunshine.

Among the diseases that may be acquired by contact are ophthalmia, syphilis, gonorrhea, and tetanus. Typhoid fever is now frequently classed among diseases acquired by contact. The nurse's hands too often become carriers of infection to herself and others.

Smallpox, scarlet fever, measles, mumps, chicken-pox, whooping-cough, influenza, diphtheria, erysipelas, and pneumonia have been classed as air-borne diseases, which practically means that the disease is believed to be usually communicated by means of floating dust.

The air-borne theory of many diseases is a matter of dispute between sanitary authorities at the present time. The results of research have greatly narrowed the list of air-borne diseases, and emphasized the importance of using all possible precautions to prevent infection by contact. It has been proved that when aseptic precautions are observed in dealing with so-called air-borne diseases, the danger of the spread of infection is slight.

Rules for prevention of infection in use in many hospitals are as follows:

To Avoid Taking and Carrying Infection.[1]—Keep fingers, pencils, pins, labels, and everything out of your mouth.

Keep and use your own drinking-glass.

Do not kiss a patient.

Wash hands often, and always before eating.

Keep out-of-doors as much as possible, and always sleep with window open.

Do not touch face or head after handling a patient until hands are washed.

Do not allow patient to cough or sneeze in your face.

Do not allow patient to touch your face.

Do not eat anything that patient may wish to give you.

If taking a drink or lunch, be sure and use the nurse's dishes.

Put on gown or change uniform when going into the ward.

On leaving ward always wash hands.

Always remember that infectious diseases are taken and carried by contact and not by air infection.

Diseases Carried by Food or Water.—Enteric fever, cholera, dysentery, and some forms of diarrhea are commonly communicated by food or water. Food which is pure and clean may become infected by the hands of the nurse who has been handling an infectious case. Tuberculosis and a number of other diseases are also known to have been carried in this way, milk being considered a specially favorable medium.

Infection Through a Wound.—Septicemia, puerperal fever, and erysipelas gain an entrance to the body through a wound or surface lesion. The germs may be carried in the air and deposited on a wound, but it is believed that infection is chiefly acquired through contact with some person or material containing the germ.

Typhoid fever caused by the bacillus typhosis (sometimes called Eberth's bacillus, in honor of its discoverer), is taken into the system usually through the mouth by means of water or food. The germs of disease are found in the vomited matter, the discharges from the bowels

[1] City Hospital, Providence, R. I.

and urine, occasionally through the sputum. Flies are active agents in its distribution. Where the disease has been conveyed by water, the precaution of boiling all drinking-water is not sufficient. Green vegetables or fruits are sufficient to convey the infection into the system if washed in contaminated water.

Cholera, due to the comma bacillus, and **dysentery,** caused by the bacillus dysenteriæ, are communicable in the same way as typhoid fever, and the same precautions against the spread of infection are necessary.

Diphtheria is caused by the bacillus diphtheriæ, often called the Klebs-Löffler bacillus. The infection may enter the system with food, may be communicated from mouth to mouth, or indirectly through infected articles, or may enter through the respiratory tract. The germs of disease are found in discharges from the throat and nose. Whooping-cough and membranous croup may be communicated in the same manner as diphtheria.

Influenza.—The bacillus of influenza enters the system usually through the respiratory tract. The infectious matter is contained in the secretions from the mouth and nose.

Infantile paralysis is classed as a communicable disease. It is believed that the infectious matter is contained in the secretions from the nose and mouth, though, because of the disturbance of stomach and bowels which so frequently occurs at the onset, some authorities incline to the belief that the infection in such cases started in the alimentary tract. Special care is given to the disinfection or destruction of all articles contaminated with such discharge.

Scarlet fever, measles, German measles, and **chicken-pox** are believed to be communicated through the secretions from the throat and nose and the desquamating skin. Infection may take place by actual contact with an afflicted person or through infected articles, such as books, clothing, and food, the dust of the room acting as a distributing agent. Domestic animals are common factors in spreading these diseases.

Mumps is a communicable disease, but the exact

FIG. 96.—Streptococcus pyogenes ($\times$ 700).

FIG. 97.—Micrococcus pyogenes aureus ($\times$ 1000).

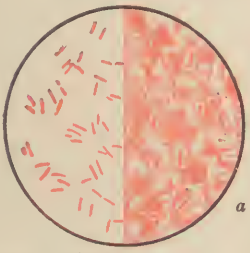

FIG. 98.—Bacillus pneumoniæ ($\times$ 800): *a*, As seen in sputum.

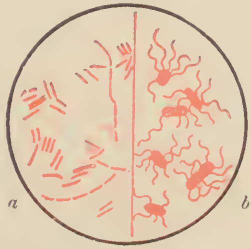

FIG. 99.—Bacillus typhosus: *a*, Ordinary form ($\times$ 1000); *b*, flagellate form ($\times$ 1500).

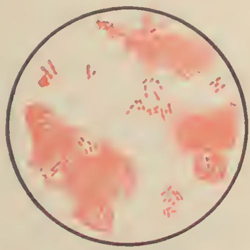

FIG. 100.—Bacillus influenzæ in nasal secretion ($\times$ 1000).

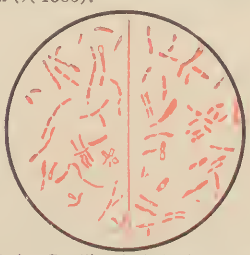

FIG. 101.—Bacillus diphtheriæ ($\times$ 1000).

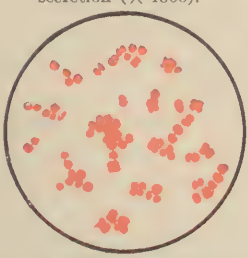

FIG. 102.—Micrococcus meningitidis cerebrospinalis ($\times$ 1000).

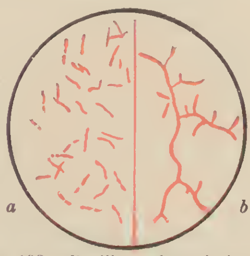

FIG. 103.—Bacillus tuberculosis: *a* ($\times$ 1000); *b*, ramified or branching form.

method of communication is not yet accurately determined. It is deemed advisable to disinfect all discharges from the throat and nose.

Tetanus is always contracted through wounds, the infectious matter being eliminated through the pus and discharges from wounds.

Tuberculosis, caused by the bacillus of tuberculosis, may invade any organ of the body. When the lungs are attacked, the disease is termed consumption or phthisis, scrofula, when the lymphatic glands are invaded, and lupus, when the disease attacks the skin. The infectious matter is eliminated through the secretion, and pus from wounds, through the expectoration or discharges from the part affected. It may enter the system through the respiratory or alimentary tract or through wounds. Dried sputum carried in floating dust is largely responsible for its spread. Kissing and the use of tableware used by a consumptive patient may also convey the infection.

Malaria is now classed as a communicable disease. It is conveyed from the sick to the healthy by means of a certain variety of mosquito.

Pneumonia is caused by the diplococcus pneumoniæ. This microörganism is said also to cause meningitis, pleurisy, ulcerative endocarditis, sore throat, and some other diseases of an inflammatory character. The infection enters the system through the respiratory tract and is eliminated through the secretions from the seat of the disease, usually through the sputum, or may be communicated from mouth to mouth, as in tuberculosis.

Erysipelas is caused by the streptococcus pyogenes, which enters the system through wounds which may be so small as to be unnoticed by the naked eye. The infectious matter is eliminated in the pus and discharges from wounds or the desquamating skin of the part affected. It may be acquired by actual contact or conveyed in clothing or infected articles.

Cerebrospinal meningitis is caused by a micrococcus. Present theories are that it is not carried in clothing nor

directly communicated from the sick to the well, nor is the infectious matter found in the excretions so long as there is no lesion of the brain or spinal cord. It is deemed best to disinfect all the discharges of the body and such articles as come in contact with the patient, following with formaldehyd fumigation.

Hook-worm disease occurs most frequently in tropical countries. It is common in the southern part of the United States. It is caused by the uncinaria or hookworm, which enters the system in several ways. It may be taken into the body with food or drink through the mouth, but is believed also to enter through wounds in the skin. The disease is classed as a parasitic disease. The discharges from the bowels contain the infectious matter, and preventive measures are directed to the proper disposal of the feces. It has been found that persons who go barefooted or who work in damp earth are more liable to contract the disease.

Yellow fever, like malaria, is communicated by means of a mosquito. It may be transmitted by direct inoculation of blood from a patient suffering from the disease, but is not distributed in the air, clothing, or infected articles. Prophylaxis consists in the destruction of the insect through which the disease is communicated.

Bubonic plague is caused by the bacillus pestis, discovered by Yersin in 1894. It may enter the body through a wound and result in a local inflammation, which quickly spreads to the lymphatic glands. These glands when swollen are termed buboes. It may also enter through the respiratory or the alimentary tracts, and infection may be conveyed by means of the discharges from the wounds, the expectoration, or any of the discharges from the body. Flies, rats, mice, and insects assist in spreading the disease.

Smallpox.—The exact cause of smallpox has not yet been discovered, but is generally believed to be of bacterial origin and that the infective matter enters in most cases through the respiratory tract. It may also be introduced through the skin. The disease is so readily communicated that all discharges from the body should

be disinfected. The desquamating skin is probably the chief factor in spreading the disease, though undoubtedly the secretions from the throat and nose contain the specific virus. Flies alighting on the skin or clothing of the patient may readily convey the infection from one home to another.

Prophylaxis consists in isolation, vaccination, and thorough disinfection. Every possible means should be used to prevent the desquamating particles of skin and dried secretions from the eruption being distributed as floating dust. Inunction with antiseptic ointment, bathing in weak disinfectant solution, thorough and prompt disinfection of all aticles used, and fumigation with formaldehyd vapor are the means depended on to prevent the spread of the disease.

Incubation Period.—The period of incubation is the time which elapses between exposure to the germ and the time when active symptoms of disease are manifested. The period varies with different diseases.

Natural Resistance.—Each human body has within itself a certain amount of resistive power, as well as the capacity for repair. The various groups of cells forming the brain, kidneys, stomach, etc., have a natural recuperative tendency. There are in the body certain kinds of cells, among which are the white blood-cells or leukocytes, whose function it is to protect the body from disease. These cells, to which the general term "phagocytes" has been given, constitute the standing army of the body. When disease-producing bacteria gain an entrance to the body and lodge there, they are attacked by the phagocytes. The precise methods of warfare are still to some extent a subject on which scientists differ. Prudden says, "The cells attempt either to swallow and thus kill and digest the bacteria, or to so closely surround them as to cut off their oxygen and so destroy them." When the body is in full vigor the poisonous germs are easily overcome. When the bacteria are of a very virulent type they are able to arrest the action of the

phagocytes and to multiply and produce their poison in the system.

All human beings do not start out with an equal amount of resistive power. Some persons are, by some peculiarity of tissue inherited from their ancestors, much less susceptible to all forms of disease than others, while other individuals exhibit a peculiar resistance to certain infectious diseases, all efforts to produce the disease by artificial means proving futile. A common example of this latter form of natural immunity is found in persons on whom successive vaccinations with the smallpox virus produces absolutely no effect.

Opsonins.—The term "opsonin" is derived from a Latin word, meaning "I prepare a feast for" or "to prepare food for." It is defined as follows: "That constituent of the blood-serum of a normal animal which renders bacilli or blood-cells prone to be absorbed by phagocytes." (Dorland.)

To Sir Almoth Wright, of England, is due the discovery of opsonins and the development of opsonic treatment, which is designed to increase the power of resistance of the body to infection and to overcome attacks of bacterial diseases by the administration of a suitable vaccine.

Opsonic Index.—By this term is meant the degree of opsonic potency which the blood-serum of an individual represents toward a particular germ. This is ascertained by a laboratory process. Conditions which lower the normal restive powers of the body cause the opsonic index to be lowered.

The **Schick test** is now much used to determine the susceptibility of individuals, especially children, to diphtheria. If the blood contains antitoxin, nothing happens, and the patient is declared to possess natural immunity. If the test is positive a prophylactic serum may be administered to produce protection against diphtheria.

Acquired immunity is conferred on an individual by one attack of certain specific diseases, notably those commonly classed as children's diseases, such as measles, etc. It implies that certain changes have been produced

in the tissues by the action of the disease germs, so that he is protected from subsequent attacks. In some diseases protection for life seems to be acquired by one attack. In others the attack serves to protect for a period of years only. In certain diseases, such as influenza and pneumonia, one attack, instead of protecting from others, seems to predispose to subsequent attacks.

Artificial immunity is that form of immunity which is produced by antitoxins. The antitoxic theory is based on the idea that as each germ produces its own special toxin, so each of these toxins must have an antidote or antitoxin, which will neutralize the poisonous effects of the germ. The antitoxins for diphtheria and tetanus have proved very valuable. Other so-called antitoxins have proved failures, but the subject is still being carefully investigated.

It may be assumed that those who maintain themselves in the best physical condition are the least susceptible to the activities of disease-producing germs when such gain access to the body. If we breathe impure air and wilfully shut out Nature's provision for purification; if, instead of choosing plain, easily digested, nutritious foods, we force on on our systems injurious concoctions; if we will not take time to masticate food thoroughly; if we will not rest and play enough, or rest and play too much; if we persist in "burning the candle at both ends"; if we allow worry to take possession of us, we cannot expect to resist the strain when attacked by disease.

Contact Infection.—The theory of contact infection, which has been for many years accepted as the chief source of danger in surgery, is also gaining ground in dealing with such diseases as measles, whooping-cough, diphtheria, scarlet fever, and typhoid fever. Experience goes more and more to show that the nurse is in large measure responsible for infection when it occurs, and her personal responsibility for carrying out a systematic preventive technic for her own safety as well as for the safety of others cannot be too fully impressed on her from the day of her entrance to the hospital.

CHAPTER XXV

SURGICAL CLEANLINESS AND DISINFECTION

THE cocci or micrococci, the spheric-shaped germs, are those most commonly encountered in surgery. They are the chief pus-producing germs and are always in the discharges from abscesses, boils, and unhealthy wounds. They are also the cause of septicemia and various other forms of blood-poisoning. None of these diseases can occur without them.

In describing these particular germs the term "pyogenes" is used, which means pus producing.

The **staphylococcus pyogenes aureus** ("aureus" means yellow), or the yellow pus germ, is found not only in boils or abscesses, but in many forms of disease which attack the skin and mucous membrane. It is practically always present in hospital wards. A favorite lurking place in the body is underneath the edges of the finger-nails. (An authority on bacteriology states that the ordinary clean hand contains about a hundred varieties of germs, not all of which, however, are harmful.)

The **streptococcus pyogenes** is one of the most frequent causes of postoperative peritonitis and cellulitis. It is also a common cause of pus. When pus forms in a wound, the process is known as suppuration.

The **pneumococcus,** the pneumonia germ, not only is able to cause that disease, but is also a frequent cause of inflammation in wounds. Abscesses of the ear and in the pleural cavity and meningitis are in many cases due to it. It is commonly present in the dust of the street.

The **bacillus of tetanus** is always to be feared in accidental wounds which have become infected with the dust of the street, cellars, or stables.

The **bacillus coli communis** is normally present in the bowel. It is found, as a rule, in appendicitis, and is an important factor in producing inflammation of the urinary organs and peritonitis.

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The **gonococcus** is the cause of gonorrhea. It grows readily on the mucous membrane of the eyes, producing gonorrheal ophthalmia, and is a frequent cause of ovarian abscess and inflammation of the genital organs. These germs live but a short time outside of the human body. Infection by the use of towels containing gonorrheal discharge or from water-closets does occasionally occur, but the most frequent mode of infection is by contact with some one having the disease. Infection of the eyes very often results from rubbing them with infected hands, hence the need of extreme caution in nursing this class of cases.

The **bacillus of tuberculosis** is the cause of a large number of wounds. About one-fourth of all chronic surgical cases are said to be tuberculous. Hip-joint disease, Pott's disease, and various other diseases, mostly those of bones, joints, or glands, are caused by it. The pus-producing germs flourish in tissues already attacked by the germs of tuberculosis, and mixed infections are very common.

It is highly important to remember that the pus germs are found in abundance on the skin and mucous membranes, particularly in folds and creases of skin, as in the axilla, hands, and groin. They are also in all the orifices of the body and in the secretions, in dust, and on everything exposed to air or dust.

METHODS OF DESTROYING BACTERIA

Sterilization implies the complete destruction of the vitality of all organisms that may be present in or upon the substance to be sterilized. It can be accomplished by the proper application of either heat or chemical agents. It should be remembered, however, that a thing may have been sterilized, but not be sterile. Exposure to the air of material that has been sterilized will quickly render previous sterilization of no effect in ensuring surgical cleanliness.

Disinfection implies the destruction of all germs that

have the power to infect, but not necessarily of all the bacteria present.

Antiseptics are substances which prevent the growth of bacteria without, of necessity, destroying them. A substance may be an antiseptic without possessing disinfecting properties, but a disinfectant is always an antiseptic.

Germicides and disinfectants are interchangeable terms. Both destroy infectious germs.

Deodorants are agents which neutralize offensive odors.

Heat.—The most effectual of all methods in the destruction of germs is heat. Fire is the greatest of all purifiers, and is generally employed in disposing of infected material in the form of soiled dressings from wounds and useless dangerous materials.

Hot air, steam, or boiling water are usually employed in the sterilization of mattresses, clothing, and surgical dressings. Surgical cleanliness requires the use of both chemical germicides and heat, as neither is applicable to all substances.

Boiling is one of the easiest and most effective of all methods of sterilization. It has been proved that a degree of moist heat much below boiling-point is sufficient to destroy a large number of infective agents. Expert bacteriologists claim that a temperature of 158° F. will destroy the germs of typhoid fever, diphtheria, tuberculosis, erysipelas, pneumonia—in short, practically all non-spore-forming bacteria within one-half hour, and that a temperature of 212° F., or boiling-point, destroys them at once.

Boiling water is made still more effectual in the cleansing of floors, furniture, etc., by the addition of bichlorid of mercury or some other germicidal agent.

For the disinfection of surgical instruments ten minutes' boiling is sufficient. Soda bicarbonate is often added to the water in which such instruments are boiled to prevent rusting.

Baking, or **dry heat,** is not so reliable as moist heat

as a disinfectant. It lacks penetrative power and injures most fabrics. In the absence of a sterilizer, baking may have to be resorted to. A temperature of about 230° F. in an oven will destroy the germs of most of the communicable diseases. In the absence of a high-registering thermometer authorities have stated that baking for one hour at a temperature slightly below that which will brown or scorch cotton goods will accomplish the disinfection of small articles. This method is liable to damage cotton, woolen, or linen goods by rendering them brittle.

Steam Sterilization.—Exposure to live steam for from one-half hour to an hour, the length of time depending on the amount of steam pressure, is sufficient to destroy all but the most virulent germs. Exposure for one hour with steam at its ordinary temperature and pressure is relied on to destroy both bacteria and spores. When it is possible to secure a considerable degree of pressure, the time required to sterilize usually does not exceed one-half hour. Steam at a pressure of 15 pounds to the square inch will surely sterilize in twenty minutes. Steam injures silk clothing, leather, fur, skins of all kinds, and rubber goods of all kinds that are made of impure rubber. In arranging articles for steam sterilization care should be taken not to make bundles large, not to wedge the articles in tightly, and to remove the tops of all jars or bottles. Otherwise the steam cannot penetrate, and sterilization cannot be relied on.

Intermittent or *fractional sterilization* consists in exposing the articles to be sterilized to the action of steam for three successive days. The theory underlying the practise is that spores of certain bacilli have been found to retain the power to germinate after an exposure of hours to the temperature of boiling water. The object of intermittent sterilization is to destroy all bacteria that may have developed from spores after the first sterilization. This method is frequently necessary in laboratory work, but is rarely required in general surgical work. Regarding the practise of intermittent sterilization as carried on in

some hospitals, Dr. Charles Harrington, late of the Harvard Medical School, says,[1] "The most resistant pathogenic spores are killed by a few minutes' boiling. In the case of dressings treated properly with steam under pressure, both the bacteria and the spores present are destroyed with one exposure, for even very resistant spores cannot resist steam under 15 pounds of pressure for ten minutes. But supposing they could, what effect would a second treatment on the following day have upon them? None whatever, for in the absence of moisture and nutrient material they could not develop into bacilii, and so long as they remained spores they would within reasonable limits retain their resistance. So a second exposure would be as futile as the first, and a third, fourth, and fifth would be equally barren of results."

The same authority calls attention to the danger from bacteria in the air of the operating-room, as follows: "A sterile Petri dish was placed upon the instrument table during an operation for hernia. At the close of the operation the dish was removed and incubated. The result demonstrated that upon each square inch of the dish, and inferentially of the table and the instruments thereon, and presumably on the field of operation, no less than 120 organisms, chiefly pus cocci, were deposited from the air in the course of an hour."

Spore-bearing Bacteria.—Most of the germs which cause the common communicable diseases do not produce spores, and it is only under exceptional conditions that spores need to be considered in disinfection. Spore-bearing bacteria are encountered in tetanus, anthrax (a disease which occasionally attacks tanners, butchers, and workers in hides), and malignant edema. The germs of cholera, typhoid fever, dysentery, pneumonia, diphtheria, erysipelas, influenza, cerebrospinal meningitis, tuberculosis, and pus-producing germs do not have spores and are readily destroyed by the ordinary methods of disinfection, intelligently used. In sterilizing after a case of

[1] *Some Studies in Asepsis.*

tetanus at least twice as long exposure should be allowed as under ordinary conditions.

Some Facts About Asepsis.[1]—Asepsis is the absence of septic matter, or freedom from infection:

"1. No wound is absolutely free from germs.

"2. In cases where wounds heal by primary union (very quickly) this does not mean that no germ has entered, but that so few germs have entered and the severed tissues have been so little damaged that the tissues have killed or rendered harmless the few germs present in the wound.

"3. When pus forms in a wound made through healthy skin and into healthy tissues, it is usually due to some of the following causes:

"(*a*) An enormous number of germs put into the wound during the operation.

"(*b*) Severe damage to the tissues during the operation by manipulations of the operator, or by chemical irritants in the form of antiseptics.

"4. Mechanical cleansing for ten minutes with sterile nail-brush, soap, and water removes 99 out of every 100 germs on the surface of the skin.

"5. No chemical irritant (commonly known as an antiseptic) can kill germs in a wound without also killing the tissues of the wound.

"6. In cases infected before operation, never forget that however badly infected the wound may be, it is always possible by introducing more germs to make the infection worse.

"7. In dressing a wound it is essential to take the same precautions as during operation. Whenever possible, use boiled rubber gloves in dressing wounds or in handling dressings soiled with discharge from a cavity, or handle all soiled dressings with forceps.

"In doing dressings without gloves where pus is present, the nurse runs the risk of:

"(*a*) Of infecting herself.

[1] C. Hamilton, Whiteford, M. D.

"(*b*) Of carrying infection to the next patient.

"8. Mechanical cleansing and application of iodin will render the skin surface almost free from germs, but germs are still found in the deeper parts of the skin.

"9. The mouth and nose of every adult are full of germs. One drop of saliva contains as many germs as a drop of sewage.

"10. Never forget that the theory of aseptic surgery is simple, but the practical application of the theory is most difficult, and can only be successfully carried out by the co-operation of every one connected with an operation. Any careless person, by neglect of a single elementary precaution, can spoil the result. What is known as the "aseptic conscience" is essential for obtaining aseptic results. The worker who develops an 'aseptic conscience' avoids breaking rules of asepsis, because he wishes to give the patient the best possible chance for an uncomplicated recovery."

General Considerations Regarding Disinfectants.—In selecting a disinfectant solution a number of points should be considered:

1. The kind of germ to be destroyed.
2. The material in which the infectious matter is incorporated.
3. The amount of matter to be disinfected.
4. The strength and temperature of the solution.
5. The effect the disinfectant is likely to have on surrounding substances that will be exposed to it.
6. The time required for the solution to destroy the germ.
7. The composition of any material associated with the matter to be destroyed.

Some bacteria are much more resistant than others and require longer exposure.

Some disinfectants (bichlorid of mercury, for instance), when the chemical substance comes in contact with albuminous matter in stools or sputum, coagulates the albumin, and at once forms a coating around the infectious matter

which prevents the solution coming in contact with any but surface germs, making it unreliable as a disinfectant for that class of matter.

Some chemicals have been found to quickly destroy certain germs, while they seem inert toward others or practically so.

The strength of a solution is always important and also the temperature. All chemical disinfectants are more powerful if applied hot. A solution with but feeble antiseptic properties when used cold, has been found to be a powerful germicide when applied hot.

The effect of the chemical on different materials should always be considered. For instance, corrosive sublimate should not be used on metals, or chlorid of lime to disinfect clothing.

The time the infectious matter is exposed to the solution is also important. If an infected stool to which a disinfectant is applied is at once emptied into the sewer, where the disinfectant is diluted with volumes of water before it can act, then disinfection of the stool has clearly not taken place, even though the nurse may have gone through the motions, applied the solution, and apparently carried out the rules. Such disinfectant is wasted and the infectious substance is not disinfected. Further, if the stool is freely mingled with urine, the urine at once dilutes the disinfectant just as the same amount of water would dilute it, lessens its strength, and a stronger solution or a much larger quantity should be applied than if no urine was present. In disinfecting urine, enough of the chemical should be added so that when applied to the urine the whole solution or amount of fluid should be equal to a 5 per cent. solution of carbolic acid, a 1: 1000 solution of bichlorid of mercury, or a 3 to 5 per cent. solution of formalin.

Disinfection of Air.—"If the air of a room is infected, the best method of disinfecting it is to open the windows, and a few moments' time will serve to replace it by fresh, uninfected air. And in so doing there need be no fear

of endangering the health of the neighborhood, except in case of smallpox. Infected air is soon dissipated by the enormous dilution of the atmosphere, and by the action of the sunlight, the winds, and the rain, thus rendered inert. The actual solid substances that then remain in an infected room after flushing out its atmospheric contents are the walls, the ceiling and floor, the beds and bedding, furniture, etc." (Gould.)

Sterilization of air is accomplished, or practically so, in some of the large operating-rooms by a filtering process. The air is pumped in from outside, washed by passing it through water, filtered through successive screens of cotton warmed by steam, and carried into the operating-room through a special air-shaft.

Disinfection of Rooms and Contents.—As a general rule, gaseous disinfectants are employed for disinfecting the room and general contents. For this purpose formaldehyd is the gas most frequently used. (For general rules for using gaseous disinfectants, see chapter on Antiseptics and Disinfectants.) It should always be remembered that no gaseous disinfectant can be depended on for more than surface disinfection. The time of exposure needed and the strength of the gas have been actually determined, so that a nurse need not depend on guess work regarding the quantity that should be used to thoroughly disinfect. As it is practically impossible to make an ordinary room airtight, and there is always more or less waste, an excess of gas over the prescribed amount is desirable. As none of the fumigating agents possess the power to penetrate closed doors or beneath surfaces, all possible surfaces should be exposed by opening drawers, closet doors, and hanging clothing and bedding on lines across the room. Because of the slowness with which the gas is generated, formaldehyd lamps, candles, pastils, etc., are considered unreliable as disinfectants.

Natural Disinfection.—Ordinary cleanliness, dryness, and sunshine are important aids in the work of disinfection, as well as in the prevention of disease. Not half

enough value is placed on sunshine as a destroyer of germ life. Expert bacteriologists have found that few of the pathogenic bacteria can live many hours exposed to the direct effect of the rays of the sun. Dryness is destructive to many disease germs, and dryness and sunshine combined are said by expert disinfectors to be almost as effectual as the disinfecting processes commonly used in the disinfection of houses.

The *control of communicable diseases* is fully discussed in pamphlets which may be secured free by addressing the United States Public Health Service, Washington, D. C.

In all cases the least that should be done is to see that all furniture and equipment that has been in intimate contact with the patient receives as thorough cleaning as is possible to give it. In cases of tuberculosis or leprosy renovating by repainting all surfaces that can be so treated is recommended, following the free use of soap and water and disinfectants.

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SECTION V

THERAPEUTICS AND MATERIA MEDICA

CHAPTER XXVI

REMEDIAL AGENTS

THE term **therapeutics** was originally defined as that branch of science which deals with the application of drugs in the treatment of disease. Therapeutics, in the modern conception of the term, is defined as "that part of medical science which treats of the discovery and application of remedies for diseases." A still further conception of the province of therapeutics is embodied in the statement that: "The science of therapeutics includes the use of any method or agency for the amelioration, cure, or even the prevention of disease." Before beginning the study of therapeutics or drugs it is well to have at least a slight understanding of the causes which make remedies a necessity.

Disease is a derangement of the structures or functions of the body. The *causes of disease* are exceedingly numerous, but may be roughly divided into the following classes:

1. Abnormal condition of the external surroundings of the human body, such as the action of heat, cold, light, electricity, etc.
2. Abnormal use of the organs of the body. This would include excessive or deficient exercise of any part, insufficient mastication of food, etc.
3. Accidents or mechanical violence.
4. Pathogenic bacteria and parasites.

A large proportion of the diseases of modern life are traceable to the latter cause.

While a nurse is not called on to institute or outline treatment for disease, it is well for her to understand that in making choice of remedies it is considered desirable always to use those which will accomplish the result desired with the least tax on the vital powers. It is common to speak of the action of a medicine or remedy, but in reality the agent is passive. The results are produced by the action of the living tissue upon it. The remedial property of the agent used in each case is an expression of the manner in which the system receives it, not the action of the remedy itself.

Self Repair.—The human body is endowed with the power to repair itself. A constant death of tissue goes on from birth to death. Cells of skin and of all the tissues of the body are dying and new tissue is being formed incessantly. Nature always tends toward repair and self-preservation, and if external conditions are properly adjusted, will often effect a cure without the application of any of the so-called remedial agents. The oft-quoted remark of a famous French surgeon, "I dress wounds, but God heals them," is true. The utmost that man can do is to study Nature, assist her efforts, and endeavor to work in harmony with her. A common example of Nature's methods is seen when a splinter or thorn is forced into the deeper tissues of the hand. The individual may be unconscious of its presence, but it is recognized at once as a foreign body by the natural protectors of the body. The white blood-corpuscles rush to the scene to force it out. A series of changes take place in the tissue, which constitute the local manifestation of the attempt to eject the intruder and repair the damage. Nature's methods, however, are not always intelligent, and in the intense efforts put forth toward self-preservation, harm is often done. Stimulation of natural effort is often needed, and probably, quite as frequently, it is necessary to check or modify Nature's efforts. While, as previously stated, it is not the province of the nurse to treat disease except as ordered by a physician, yet, if a nurse is to be an intelligent assistant to the physician, she should have a general

knowledge of the common principles of treatment. She should know what he is trying to do and to a certain extent why he does it. It is also recognized that there are so-called nursing treatments which a nurse should be able to give without having to be told every detail, and the principles underlying the so-called nursing treatments do not differ materially from the underlying principles of the treatment of disease in general.

The following general principles of treatment might properly be taught to people in general, since most people are obliged to do something toward the treatment of human ills at some time in their lives.

General Principles of Treatment.—1. Remove the cause of the disorder or derangement if possible. For instance, if the cause of a headache is bad air, the sensible thing would be to supply pure air, rather than dose with headache powders. If the cause of diarrhea is unwholesome food, the sensible thing would be to get the irritating substance out of the system as quickly as possible, and then supply wholesome food.

2. Secure rest as far as possible for the part affected. A large number of cases of disease will be corrected spontaneously, without assistance, if rest can be secured for the injured or affected part. This is especially true of diseases of a surgical nature.

3. Keep the patient and surroundings clean. To keep the patient at rest; to give him clean air to breathe, clean suitable food and drink, with clean clothing, a clean bed in a clean room, is to provide the most favorable conditions possible for Nature to carry on her restorative work.

4. As far as possible, use natural remedies, or those which are essential to maintaining life and health. This would include the use of water, fresh air, light, heat, proper diet, and wholesome mental influences. To a certain extent, a nurse will be expected to use all these natural remedies as a part of nursing treatment. In other words, if the proper adjustment of these various conditions will effect a cure, drugs are rarely used by intelligent people.

5. Refrain from interfering with Nature unless a remedy is clearly demanded. A great many diseases are caused by well-meant interference with Nature's work. The constant drugging that goes on in some homes is a fruitful cause of disease. The abuse of the vaginal douche, which, when properly used, is a useful remedial agent, is another common illustration of this point. A vigorous letting alone is sometimes the best of all remedies.

Diseases are commonly classed as functional or organic.

In **functional disease** the organ may be unable to do its work properly though its tissues are apparently in normal condition. A great many functional diseases are treated successfully by bringing certain influences to bear on the mind or nervous system.

In **organic disease** there is a change in the tissue or structure of the organ.

There are but very few diseases for which there has been discovered a sure, so-called "specific" remedy, and the exact manner in which an individual will respond to the use of a remedy cannot always be foreseen. Drugs which prove immediately successful with one patient, may fail in the next similar case, and the reason for success or failure is not always easy to see. Each individual is a study by himself, and nurses should learn to nurse the patient, not the disease; to observe intelligently and report accurately anything that is likely to have a bearing on the case. Many of the functions of human organs are but imperfectly understood. The work performed by the spleen is still a source of perplexity. The mysteries of the liver have never been fully unfolded. The processes of digestion and nutrition are exceedingly intricate and complex, and afford still a wide field for scientific investigation. Even the causes of the simple act of vomiting are but little understood in many cases.

Sources of Remedies.—In the selection of remedies, choice may be made from the animal, vegetable, or mineral kingdom. A comparatively small number of drugs are furnished by the animal kingdom, but these form an exceedingly important group. Such remedies as antitoxin

and vaccine are secured from living animals. Pepsin, pancreatin, and various other drugs are obtained from certain organs of animals after death.

The vegetable world furnishes a great variety of drugs. Flowers, leaves, stems, fruit, and roots are all utilized, and all countries of the world have made valuable contributions from their products for the cure or alleviation of disease.

Regarding the action of vegetable drugs, much misunderstanding exists among the laity. One of the favorite boasts of the proprietors of patent medicine establishments is that their drugs are perfectly harmless, prepared entirely from vegetables, and free from mineral poisons. It is well known that some of the most strongly poisonous drugs are made from plants. No fact concerning drugs needs more frequent emphasis than that practically all drugs are poisonous, and all are capable of doing much harm unless intelligently used.

The mineral kingdom has made many important contributions to the list of drugs in common use. Common examples are lime, iron, chalk, lead, soda, salt, potash, mercury, silver, with their numerous combinations and preparations.

Prophylactic remedies are those which have for their object the prevention of disease. These would include the proper regulation of all the varied factors that have to do with the general health—sanitary conditions of homes and surroundings, as regards cleanliness of dwellings and general conditions, water, purity of air and food, occupation, habits, exercise, clothing, etc. It would include the proper management of baths of various kinds, dieting, gymnastics or physical culture; in short, anything that has to do with hygiene, general or personal.

Imponderable remedies are remedies which cannot be weighed. They include the invisible forces, such as heat, cold, electricity, magnetism, light, etc. All these exert a powerful influence over the vital functions of the body, and are much in use both as preventive and curative agents.

Mechanical Remedies.—In this list are included surgical procedures, massage, etc. Surgery, from "chirurgery" (handiwork), means that part of the medical art which deals with the external parts of the body, and with such ailments as can be seen or touched and helped by handiwork, removed by knife or other instruments, soothed by fomentations, or supported by splints or bandages.

Medicinal remedies include all drugs used for the relief, cure, or prevention of disease.

Materia medica is that branch of medical science which devotes itself to the study of drugs—their botany, chemistry, derivatives, and their action on the human body.

Miscellaneous Remedies.—Besides these classes of remedies, there are a great many others which have been found to exert a certain influence in preventing or curing disease. That the state of mind has a powerful influence over the body is admitted by all who have given thought or study to the subject. In recent years a much greater emphasis has been placed on the mysterious powers exerted by the mind, and many forms of disease are treated by suggestion or mental influence, in combination with, and often without, other remedial measures. The cures wrought by this means are mainly or entirely of functional diseases, or diseases in which the functions of the organ, and not the tissues of which it is composed, are impaired. To this method of treatment the term "psychotherapy" is given.

Occupation of a suitable kind is employed as a remedial measure in many forms of nervous and mental troubles. So valuable is it considered in its effects on mental and nervous diseases that few institutions devoted to the care of these classes of cases would be willing to dispense with it. The kind of occupation prescribed is a matter of study with each individual, but it is considered as a prescription, to be carefully and regularly administered, just as are medicines.

Music, suitable reading, and games are also used as remedial agents in certain cases. Gymnastic exercise is used both for preventive and curative effects.

The **rest cure,** which includes rest for the body and mind as far as it is possible to secure it, combined with other remedial measures, is another common form of treatment.

Hydrotherapy is that branch of therapeutics which treats of the use of water as a remedial agent. Its importance is becoming recognized more each year, and a knowledge of the best methods for using this simple, easily obtainable remedy, so that the best results may be secured, is considered essential to the modern nurse.

Organotherapy, sometimes termed "hormone-therapy," consists in the use of animal extracts for the cure or relief of various disorders. This comparatively new form of treatment is based on the belief that "in certain animal organs there are substances which have a stimulating or a regulating influence on the corresponding organs in man when properly administered." (See page 125.)

Pharmacology is the science that treats of drugs—their sources, botany, chemistry, preparation, poisonous effects, etc.

Pharmacy is the art which analyzes and identifies drugs and provides suitable forms of administration.

Toxicology is devoted to the poisonous effects of drugs, together with their proper antidotes, as well as other means of combating or antagonizing the effects of poisons in the body.

Chemistry is that branch of science which treats of the composition of substances and the changes which they undergo.

A **pharmacopeia** is an official list or authorized publication of standard drugs. In America such a list is prepared and revised at definite intervals by representatives of the medical and pharmaceutical professions.

Official drugs are those recognized by the pharmacopeia. They are guaranteed to be of a uniform strength.

Dispensatories are commentaries on the pharmacopeia. They are not official publications. Their list of drugs contain both official and unofficial drugs.

General Considerations.—It will be seen that the

giving of drugs is but a small part of medical treatment. Many ill people are conducted successfully through an illness without resort to medicines, for instance, many obstetric cases, minor surgical cases, and mild fevers. The tendency is to depend less on medicines and to put more emphasis on preventive measures and general instruction as to daily life and habits, but the giving of medicines is still an important part of a nurse's duties.

Practically, all text-books and most teachers have stated in substance that "a well-trained nurse never diagnoses and never prescribes." It is emphasized until every nurse in a hospital soon learns that her business is to administer remedies, not to prescribe them. Most physicians and teachers make emergencies an exception to this rule. Yet, under the social conditions of the age in which we live, it is not considered either desirable or necessary to have a doctor's order for every dose of medicine that is taken in every home or by every individual. Each household has its family remedies which are used as occasion arises, without medical orders. What should be the nurse's attitude toward such remedies? Is she at liberty to prescribe them? If so, what is the limit of her authority?

Suppose she is nursing in a family in which a child has croup. Is she to say when appealed to, "Send for the doctor, I don't know what is the matter, and, being a nurse, I am not allowed to do anything to relieve the trouble without a doctor's order"? Is she never to prescribe peppermint when a baby has the colic? Is she never to mention that a headache may be due to constipation, and prescribe a cathartic or an enema? In minor ailments very frequently no doctor is called. For instance, in colds, diarrhea, chicken-pox, mumps, etc. When she is appealed to in such cases, is she at liberty to prescribe? If so, where should she stop?

It is hardly possible to settle all such cases by arbitrary rules, but one general rule may be given, that, while negative, will cover a great many such conditions:

Give no drugs without a physician's order while there

is a physician attending the case and available for consultation.

Even this rule may have exceptions, as frequently the physician makes very few visits, as in chronic cases or protracted convalescence. A simple cathartic may have to be given or, possibly, some other simple remedy for the relief of pain. Very often such needs can be anticipated and provisional orders received from the physician. He can usually be reached by telephone.

Another rule should be to report to the physician as soon as possible deviations from orders, or drugs given without definite orders during his absence, with the reasons for giving them.

A third rule should be always to try simple natural remedies, such as heat, water, hot or cold, etc., before resorting to drugs of any kind.

After all possible rules have been made to meet such conditions, the decision as to when exceptions may be made as to nurses prescribing remedies must largely be left to the nurse's own good sense and judgment. To exceed one's authority is certain to call forth the disapproval of the physician in charge, to result disastrously for the nurse herself, and to reflect discreditably on nurses in general. It is a safe plan never to assume responsibility that properly belongs to the physician if it can be well avoided.

CHAPTER XXVII

WEIGHTS AND MEASURES AND MEDICINAL PREPARATIONS

Apothecaries' Weight

20 grains	=	1 scruple
3 scruples	=	1 dram
8 drams	=	1 ounce or 480 grains
12 ounces	=	1 pound

Apothecaries' Measure

60 minims	=	1 fluidram
8 fluidrams	=	1 fluidounce
16 fluidounces	=	1 pint
2 pints	=	1 quart
4 quarts	=	1 gallon

Approximate Measures

One teaspoonful	equals	about	1 fluidram
One dessertspoonful	"	"	2 fluidrams
One tablespoonful	"	"	4 "
One wineglassful	"	"	2 ounces
One teacupful	"	"	4 "
One tumblerful	"	"	8 "

The *minim* is the standardized drop, but drops and minims vary greatly in amount. The minim is measured, and is the same whatever the fluid may be.

The *drop* varies according to the consistency of the fluid and the surface of the vessel from which it is dropped. For example, a drop of molasses is larger than a drop of water, and a drop of water dropped from the edge of a pint measure would be larger than a drop from an eye-dropper. Each nurse should provide herself with a graduated minim glass, measuring 2 drams or 120 minims, and a graduate measuring glass holding at least 1 ounce.

In the absence of a minim glass, the following rule may be useful to remember:

Water or aqueous fluids....1 drop = 1 minim.
Alcoholic fluids............2 drops = 1 minim.
Chloroform or ether........4 drops = 1 minim.

The metric or decimal system of weights and measures is used to some extent, and is the official system of the United States Government. It is being very slowly adopted by the medical profession.

It has three standard units—the meter, the liter, and

the gram. Additional tables (including the metric system) will be found in the Appendix. In reading orders and prescriptions, it may be helpful sometimes to remember that a gram is the approximate equivalent to 15 grains, a cubic centimeter (milliter) is the approximate equivalent to 15 minims or ¼ fluidram, 4 cubic centimeters is the approximate equivalent to 1 fluidram, a liter is 1000 cubic centimeters and approximately equal to 1 quart. The common abbreviation for gram is gm., for cubic centimeter, cc. In the metric system the common or Arabic numerals are used, and are placed before the terms designating the quantity, as 50 cc. (2.50 gm.).

Medicinal Preparations.—Practically all drugs, whether in the form of leaves, bark, roots, seeds, minerals, etc., must go through a process of preparation before they are fit for administration.

Alkaloids are active principles from vegetable drugs. They are mostly poisonous or very energetic in their action. Alkaloids end in *in* or *ine*, as, morph*in* or morph*ine*.

"*Alkalies* are chemical substances whose distinguishing peculiarities are solubility in alcohol and water, uniting with fats and oils to form soap, neutralizing and forming salts with acids, turning to brown several vegetable yellows, and changing reddened litmus to blue" (Webster). Common examples are soda, lime, potash, ammonia, and lithia. Alkalies are frequently classed as antacids.

Salts is a general term applied to chemical compounds. Mineral salts, which are used as aperients or cathartics, are distinguished by various prefixes, as Epsom, Rochelle, etc.

Acids are sour substances. Chemically an "acid is one of a class of compounds generally but not always distinguished by their sour taste, solubility in water, and reddening of vegetable blues or violet colors." Acids have the power to destroy or neutralize alkalies. Familiar examples of vegetable acids are vinegar and tartaric and citric acids.

Capsules are hollow cones of gelatin, used chiefly to cover disagreeable substances.

Cataplasma are poultice substances mixed into paste for external application.

Cerates are preparations made with wax and oil for external application. They differ from ointments in that they do not melt at the heat of the body.

Chartæ or Papers.—The term is used in speaking of wrappers for powders, and also in referring to medicated papers prepared for external application.

Decoctions are solutions of vegetable substances made by boiling in water and straining. They soon decompose and require to be freshly made every forty-eight hours.

Elixirs are sweetened spiced preparations made with alcohol and water. They are a favorite method of disguising disagreeable drugs.

Extracts are solid or semisolid preparations which contain the condensed active principle of a drug.

Fluidextracts are alcoholic solutions of vegetable drugs of a definite strength.

Glycerites are solutions of medicinal substances combined with glycerin.

Infusions are solutions of vegetable substances made with either hot or cold water, without boiling.

Emulsions are mixtures of oil and water, made by rubbing with gum arabic, yelk of egg, or other mucilaginous substances.

Mixtures are watery preparations of an insoluble substance held in suspension.

Liniments are preparations of an oily or soapy nature made for external application with friction.

Tinctures are alcoholic solutions of vegetable drugs of various strengths. They resemble fluidextracts, but are less powerful.

Tablets are solid preparations in which sugar-of-milk or some similar substance is used as a medium for giving bulk and shape to otherwise very small doses of drugs.

Pills are round, solid substances used for holding medicines designed for slow action. They are soluble in the warm fluids of the mouth and stomach. Soft mass pills in putty-like masses, which may be easily flattened between finger and thumb, are now obtainable in many standard combinations. These dissolve more readily in the digestive tract.

Triturates are mixtures of drugs and sugar-of-milk in the proportion of 10 per cent. of the medicinal substance. Triturate, as a verb, means to pulverize thoroughly or reduce to a very fine powder.

Syrups are sweetened watery preparations of drugs.

Mucilages are preparations of gummy substances dissolved in water.

Wines are preparations resembling tinctures, but made with wines instead of alcohol.

Suppositories are cone-shaped bodies, made with a base of cocoa butter, for insertion into the rectum, vagina, or urethra.

Spirits are solutions of volatile substances in alcohol.

A *saturated solution* is one which contains all of a substance that can be dissolved. A saturated solution cannot be made stronger. Any excess of the drug is deposited as sediment. The strength of saturated solutions of different drugs varies.

ABBREVIATIONS AND SYMBOLS

$\overline{\text{aa}}$ (*ana*), of each.
Ad. (*ad*), to or up to.
Ad. lib. (*ad libitum*), as you please.
Alt. hor. (*alternis horis*), every other hour.
Alt. noc. (*alternis nocte*), every other night.
A. c. (*ante cibum*), before food.
Aq. dest. (*aqua destillata*), distilled water.
Aq. pur. (*aqua pura*), pure water.
B. i. d. (*bis in die*), twice a day.
C., Centigrade.

C. (*cum*), with.
C. (*congius*), a gallon.
Cap. (*capiat*), let him take.
Chart. (*charta*), paper.
Cib. (*cibus*), food.
Comp. (*compositus*), a compound.
Conf. (*confectio*), a confection.
Cc., cubic centimeter.
Cm., centimeter.
Collim. (*collunarium*), nasal douche.
Collyr. (*collyrium*), an eye-wash.
Decub. (*decubitus*), lying down.
Dol. urg. (*dolor unguente*), when the pain is severe.
Det. (*detur*), let it be given.
Dil. (*dilutus*), dilute.
D. in p. æq. (*divide in partes æquales*), divide into equal parts.
Dr. (*drachma*), a dram.
Emp. (*emplastrum*), a plaster.
Et, and.
En. (*enema*), a clyster or enema.
Ex aq. (*ex aqua*), in water.
F. (*fac*), make.
F., Fahrenheit.
Fl. (*fluidus*), fluid.
Ft. (*fiat*), let there be made.
Garg. (*gargarisma*), a gargle.
Gr. (*granum* or *grana*), grain or grains.
Gtt. (*gutta*), drop.
H. (*hora*), an hour.
Haust. (*haustus*), a draught.
Inf. (*infusium*), an infusion.
Inj. (*injectio*), an injection.
Lb. (*libra*), a pound.
Lin. (*linimentum*), a liniment.
Liq., liquor.
Lot. (*lotio*), a lotion.
M. (*misces*), mix.

Min. (*minimum*), minim.
Man. (*mane*), in the morning.
Mist. (*mistura*), a mixture.
Noct. (*nocte*), at night.
No. (*numero*), a number.
O. (*octarius*), a pint.
Ol. (*oleum*), oil.
P. c. (*post cibum*), after food.
Pil. (*pilula*), a pill.
P. r. n. (*pro re nata*), as occasion arises.
Per, through or by.
Pulv. (*pulvis*), a powder.
Q. (*quaque*), each or every.
Q. s. (*quantum sufficit*), as much as is sufficient.
R. (*recipe*), take.
Rad. (*radix*), root.
Sig. (*signetur*), let it be directed.
Sem. (*semen*), seed.
S. or **ss.** (*semis*), one-half.
Sine, without.
Stat. (*statim*), immediately.
S. v. g. (*spiritus vini gallici*), brandy.
S. f. (*spiritus frumenti*), whisky.
S. v. r. (*spiritus vini rectificatus*), alcohol.
Syr. (*syrupus*), syrup.
T. i. d. (*ter in die*), three times a day.
Tinct. or **Tr.** (*tinctura*), tincture.
Troch. (*trochisci*), lozenges.
Ung. (*unguentum*), ointment.
ʒ (*drachma*), a dram.
℥ (*uncia*), an ounce.
℈ (*scrupulum*), a scruple.

In prescriptions, numbers are expressed by Roman numerals and follow the symbols to which they relate, as: ʒj, ʒiiss, ʒiij, gr. ij, gr. iv, gtt. x, ♏v.

Specimen Prescriptions.—For obvious reasons prescriptions are written in Latin:

℞. Magnesii sulphatis........................ ℥j
Tinct. nucis vom........................ ʒj
Aq. menth. pip...................q. s. ad ℥vj.
Ft. M.
Sig.—ʒj, 4 hrs.

Translated into English this would read:

Take 1 ounce of sulphate of magnesia; 1 dram of tincture of nux vomica; sufficient peppermint-water to make 6 ounces. Let there be made a mixture. Let it be directed: One teaspoonful every four hours.

℞. Quininæ sulphatis.................... gr. xviij
Pulv. digitalis...................... gr. vj
Pulv. opii........................... gr. iij.
M. ft. pil. No. xii.
Sig —One pill t. i. d.

Take of quinine sulphate, 18 grains; pulverized digitalis, 6 grains; pulverized, opium, 3 grains. Mix. Let there be made 12 pills. Let it be directed: One pill thrice daily.

CHAPTER XXVIII

GENERAL EFFECTS OF REMEDIES AND DOSAGE

Since a vastly important part of the nurse's work is the observation of symptoms, it follows naturally that the observation of the effects of remedies used for the alleviation or removal of those symptoms deserves careful study. While each drug used is supposed to have a distinct action and effect, there are rules that apply to drugs in general as regard effects with which a nurse should be familiar.

Physiologic and Therapeutic Action.—All remedies are recognized as having a two-fold action—the physiologic and therapeutic.

By *physiologic action* is meant the ordinary immediate

effects produced in the tissues and organs of the body, without reference to disease. Thus, we know that ammonia is a powerful irritant to the skin, producing redness, blistering, and destruction of tissue.

Therapeutic effects are those which manifest themselves in the relief or removal of the morbid conditions existing in the system.

Immediate and Remote Effects.—The effects of remedies are also spoken of as immediate and remote, or primary and secondary. For instance, the immediate effect of a dose of Epsom salts is an increase in the number of, and of fluid in, the stools. The secondary or remote effect might be the lessening of the flow of milk in a nursing mother, or the lessening or removal of a dropsical effusion in some portion of the system.

Stimulants and Sedatives.—A large proportion of the drugs in common use have either a stimulant or sedative action on some part of the body.

A *stimulant* (from *stimulus*, a goad) is a remedy used to excite any organ to greater activity.

Sedatives are agents which exert a soothing influence on the system by lessening functional activity.

Stimulants are variously classified and subdivided, according to the portion of the body affected. For instance, diuretics are stimulants to the urinary system; cathartics are stimulants to the intestinal tract.

All stimulants are followed by a reaction or depression. In serious illness, where stimulation is called for, a steady stimulation is maintained by the use of frequent and regular doses till the emergency for which the drug is given is passed.

Sedatives.—Under the term "sedative" may be grouped a large group of drugs which are variously classified as anodynes, analgesics, hypnotics, narcotics, somnifacients, soporifics, and anesthetics. These remedies produce their effect through the nervous system, and drugs used for this purpose are always to be used with extreme caution.

Local sedatives are applied externally for the relief of

localized pain. Common examples of this class are ice, heat, and lotions containing opium.

The nervous system and the organs of circulation are the channels through which medicines or remedies of any kind must produce their effect on the system.

Conditions Modifying Drug Action.—A great many conditions may interfere with or reduce in extent or degree the action of any remedy:

1. The *actual condition of the individual* at the time a drug is given. Drugs cannot be depended upon to produce the same results in disease as in health. The condition of the stomach as well as the general condition of the body needs to be taken into consideration. When the stomach is empty, drugs act more rapidly. Many drugs should not be given on an empty stomach because of their irritant effect on that organ. If given after taking food, this irritant action is not produced.

2. *Surrounding conditions* may modify the action of a drug, and in certain drugs may utterly defeat the object for which it is given. For instance, the effect of a sedative may be lost by the neglect to exclude visitors, or to darken the room, or to have the patient ready for sleep when the medicine is given.

3. *Incompatibility* between medicines or between medicine and food. One drug may neutralize the effect of another. "In some cases drugs which are physiologic antagonists are prescribed, one as a guard against the action of the other, as in the hypodermic administration of morphin guarded by atropin."

4. *Age* modifies very decidedly the action of drugs. The delicate tissues of the infant or child render it exceedingly susceptible to the influence of drugs. The diminished resistive power of the aged is also taken into consideration. Strongly depressant drugs of any kind, and especially drugs which act powerfully on the nervous system, should be used with great care in the extremes of age.

5. *Sex.*—As a general rule smaller doses are required for females than for males. This is especially true of drugs

which affect the nervous system, but is true of many other drugs, notably those which are regarded as specifics for certain diseases.

6. *Imagination.*—Many individuals are very sensitive to suggestion, and the positive statement that a drug will do a certain work is a powerful aid to the action of the drug. In many cases if a patient knows what drug he is taking its effect will be lessened. The part played by imagination is clearly shown in the splendid results that frequently are obtained by the use of a placebo—an inert remedy given to satisfy a patient. Profound sleep is often induced by a hypodermic injection of water. Marvelous tonic effects are produced by pills made of sugar-of-milk, while pain is relieved and nervous symptoms allayed by similar means.

7. *Mode of Life.*—Just as hot-house plants are more susceptible to external conditions than hardy outdoor plants, so individuals whose constitutions have been made stronger and more resistive by hard work and open-air life are less susceptible to the influence of drugs than those reared in luxury and weakened by lack of exercise. Body weight also needs to be considered.

8. *Habit.*—Practically all medicines act more powerfully on one unused to them. A condition known as "toleration" follows the frequent use of many drugs and larger doses will be needed to secure the same effect. Common examples of this are seen in the effects produced on habitual users of alcohol and opium.

9. *Temperament.*—Persons having a fine-strung nervous organism are usually more susceptible to the effects of all drugs, and comparatively small doses will often produce a depression or condition of excitability that seems out of all proportion to the dose given.

10. *Idiosyncrasy* is a peculiarity of individual temperament in which frequently such uncommon effects are produced by some drugs that it is unwise ever to give them. A not unusual example of idiosyncrasy is the rash produced on some individuals by a small dose of morphin.

Quinin, even in small doses, sometimes causes severe headache, with ringing in the ears.

11. *Size of Dose.*—The size of the dose in many cases will determine its action. For instance, it is well known that whisky in small doses has a powerful stimulant action, and when taken in larger doses, or to excess, produces a profound stupor or sleep.

12. *Condition of the Drug.*—The condition of the drug at the time it is given will very decidedly influence its effects. The medicinal properties of vegetable drugs may have been weakened by age, exposure to air, or other conditions, and a prescription made according to a given formula may fail of its effects for that reason. Two druggists may make up the same prescription. One medicine may be immediately effective, the other may seem to produce no definite action. This is one of the very common complaints of physicians. The freshness of vegetable drugs is important in serious cases where immediate effects are desired. Infusions soon decompose and need to be made up freshly every few days.

Exposure to light and air will affect many drugs. A common example of this class is the solution of silver nitrate. In fact, most drugs prepared for use in the form of solution will become changed in composition in a comparatively short time.

Evaporation of the alcohol contained in tinctures and fluidextracts will increase the strength of the drug. Leaving bottles uncorked will affect a change on a great many drugs.

Pills may become so hardened with age that they may pass undissolved through the whole intestinal tract.

13. *Adulteration of drugs* has been perhaps one of the chief causes affecting the results of drugs. A notoriously common example is the adulteration of phenacetin, an imported, expensive drug, with acetanilid, a common, very cheap drug, resembling it in appearance. Substitution of a cheaper drug, instead of the one ordered, is another crime which has been practised to a considerable extent.

The pure food and drugs act has lessened materially the practise of adulteration, but the reliability of the druggist is often a matter for grave consideration in cases of very serious illness.

14. *Varied Action of Drugs.*—A large number of drugs have several different effects, and many whose potency in one direction is unquestioned, have to be avoided because of the serious after-effects produced. For instance, opium (and its preparations) relieves pain, but it also lessens the secretions, producing constipation, a decrease in urine, and various other effects. Pilocarpin is a powerful drug producing profuse perspiration. It also reduces temperature, depresses the heart, contracts the pupil of the eye, etc.

In dividing drugs into classes, the principle action of the drug or its predominant quality usually determines the class in which it is placed, but the classification of drugs is one on which there are wide differences of opinion. For instance, one physician will claim that a certain drug should be classed as a digestant; another would class the same drug as a stomachic; and another, as a tonic.

One will insist on classifying a drug as an analgesic, another as an anodyne, and another as a sedative. It is manifestly impossible for a nurse to keep posted regarding the variety of action of thousands of drugs. The class to which each may belong beyond that of the drugs in common use is not a matter of vital importance to her. She has a right to know the general effect the drug she is ordered to give is expected to produce. If she does not know, then she should inquire of the physician. Without this knowledge she cannot be an intelligent observer and ally of the physician.

15. *Accumulation.*—Certain drugs have what is called a "cumulative effect." That is, the body excretes them very slowly and they accumulate in the tissues. Common examples of this class are nux vomica and digitalis.

Drug Rashes.—Gould gives the following list of drugs which sometimes produce a transient rash: Belladonna

quinin, iodids, bromids, arsenic, chloral hydrate, turpentine, copaiba, digitalis, strychnin, acetanilid, and morphin. Other authorities mention ergot.

Impairment of Hearing.—Quinin, antipyrin, and the salicylates may cause a buzzing or ringing noise in the ears. Temporary deafness is sometimes caused by quinin, but cases of permanent impairment are rare.

The Therapeutic Limit.—In the giving of drugs there is recognized what is known as a therapeutic limit, a point beyond which it is not safe to continue the drug, at least not in as large doses. The therapeutic limit of the powerful drugs in common use should be known. Of the following drugs it is said to be:

Digitalis.—A slow, full pulse. It may fall to 40 beats a minute; vomiting, diarrhea, headache.

Strychnin.—Trembling, twitching, stiffness of the muscles of the neck, and general nervousness.

Nitroglycerin.—Throbbing headache, perspiration, dizziness.

Bromids.—Extreme drowsiness, salty or metallic taste in the mouth, eruption of pimples.

Iodids.—Headache; sore throat; general catarrhal symptoms affecting the eyes and nose; salivation.

Mercury.—Soreness of the mouth; fetid breath; salivation; a metallic taste.

Aconite.—Tingling, especially of mouth, lips, and mucous membrane; feeble, irregular pulse.

Acetanilid.—Severe depression; cyanosis; feeble pulse.

Arsenic.—Puffiness around the eyes; nausea; tightness about the throat.

Opium.—Heavy stupor; contraction of the pupils; deep respiration.

Chloral.—Slow, weak pulse.

Sulphonal.—Pinkish tint of the urine.

Atropin.—Dilation of the pupils; dryness of the mouth and throat; weak, rapid pulse.

Dosage.—The responsibility of a nurse regarding the dosage of medicines, generally speaking, begins and ends

with the administration of the dose in a proper way according to the physician's orders. This is the rule, but, as in most other rules, there are occasional exceptions. A few exceptions may be mentioned. Ordinarily it is no part of a nurse's business to question the size of a dose ordered. The responsibility for the size of the dose belongs to the physician. Neither is she responsible for the results of any remedy. But no physician is infallible. Mistakes do occur to which the physician's attention should be called, as, for instance, when a physician's attention was diverted while writing an order for strychnin, and the order read "strych. gr. $\frac{1}{3}$ every three hours." It was evident that $\frac{1}{30}$ was the dose intended.

It is unnecessary to enumerate the various causes that have led to mistaken orders being given. Such orders as aconite to be given in 2-dram doses and repeated in two hours; morphin in 5-grain doses for a baby; and strychnin in $\frac{1}{2}$-grain doses to be given every hour, have been written on hospital order-books for nurses to carry out. These are unusual, unfortunate conditions that have to be met only at rare intervals, and, perhaps, never by some nurses. Etiquette and custom have decreed that the nurse is to implicitly obey orders, but common sense and humanitarian instinct have just as certainly decreed that loyalty to orders and unquestioning obedience, which are the rule, shall not be carried to the extent of causing serious injury or the death of the patient. The laws of God and man have decreed that "Thou shalt not kill." Under such circumstances, or when in doubt, it is better to withhold the dose altogether till the error in the order can be rectified.

Another exception to the rule would be when a drug was producing an effect which the physician could not foresee and evidently did not desire or intend.

The medicinal dose of drugs is subject to great variation. The maximum dose which may be safely given and the minimum which will produce an effect have been determined by experience, but so many considerations enter

into the effects in individuals that positive statements regarding proper doses are liable to be questioned, and authorities differ materially on the question.

As the nurse administers doses of medicines she will learn the average dose. Time spent on cramming the doses of a long list of drugs will be time largely wasted, for experience has proved that neither medical students nor nurses really learn so that they retain knowledge of doses in that way. This is true as a main principle, but the average doses of the strongly poisonous and dangerous drugs in common use should be indelibly impressed on the memory as early as possible, so that an error may be quickly detected. In this list strychnin, morphin, laudanum, paregoric, nitroglycerin, digitalis, acetanilid, nux vomica, aconite, and atropin should be included.

It will be helpful also to remember the average doses of some of the different classes of drugs.

Dilute acids (such as dilute hydrochloric acid) are usually given in doses of ♏x to xxx.

Fluidextracts are usually given in doses of ♏x to xx.

Potent tinctures, dose, ♏v to xv. An exception to this rule is in giving tincture of iodin internally, when the dose rarely exceeds ♏iij.

Solid extracts, dose, gr. $\frac{1}{4}$ to j.

Spirits, dose, ♏xv to ʒj.

Syrups, dose, ♏x to ʒiv.

Infusions and *decoctions,* dose, ʒj to ℥j.

Dose for Children.—A common rule for computing doses for children under twelve years of age is: Add 12 to the child's age and divide the age by the sum. For example, if a child is four years of age, the dose would be figured in this way: $\frac{4}{4+12} = 16$, $\frac{4}{16}$ or $\frac{1}{4}$ of the adult dose would be an average dose. This rule does not apply to castor oil nor calomel, of which larger relative doses are borne by children than of most other drugs.

CHAPTER XXIX

MEDICINES AND THEIR ADMINISTRATION

Medicines may be administered by the mouth, rectum, inhalation, subcutaneous injection, by inunction, by simple application to the skin, or by application to the mucous membrane. In cases of emergency the veins are sometimes utilized for the introduction of medicinal substances. The stomach is the route usually selected for securing the absorption of medicines. There are two reasons for this: one being its convenience, and the other that the facilities for absorption which exist in the walls of the gastro-intestinal tract, through the numerous blood-vessels and lacteals, render it possible for drugs to find their way into the current circulation with comparative rapidity. Unless otherwise ordered, it is usually understood that drugs are to be given by the mouth. Exceptions to this rule would be suppositories, which are never given by the mouth and are usually intended to be given by the rectum, unless contrary orders are given.

Giving Medicines by the Mouth.—In giving medicines by the mouth much judgment must be used as to time. A great many conditions influence the time required for absorption.

Drugs will more quickly enter the circulation if the stomach is empty. All drugs must be reduced to a solution before absorption can take place, hence, it will be readily seen that medicines given in fluid form will act more quickly than in solid form.

Pills having a hard coating require a relatively long time to produce an effect, and may entirely resist the action of the digestive juices and pass undissolved through the whole intestinal tract. If there is a suspicion that this might occur, it is wise to crush the pill to a powder before giving it. The following general rules relating to the time of giving medicines may require that numerous ex-

ceptions be made in individual cases, but will be helpful as a guide.

General Rules.—1. Give when the stomach is empty if rapid action is desired.

2. Bitter tonics, designed to stimulate the secretion of digestive fluids, should be given shortly before food is taken.

3. Iron, being intended to supply to the blood an element in which it is deficient, should be given while digestion is in progress. Iron and arsenic are both somewhat irritant to the mucous membrane.

4. Alkalies, such as soda, ammonia, and lithia, are best given before meals unless intended to neutralize an excessive secretion of hydrochloric acid.

5. Acids and many other irritating substances should be given within one-half hour after food and should be well diluted. Give through a tube when possible.

6. Saline cathartics, such as Epsom salts, should be given one-half hour or more before meals, preferably in the morning. Pills and more slowly acting laxatives are best given at night when the stomach is empty.

7. Salol and remedies intended to act on the intestines instead of the stomach should be given between two and three hours after foods.

8. Cough medicines, diuretics, diaphoretics, heart tonics, and general systemic medicines are best given about midway between meals.

9. Cod-liver oil and olive oil, being somewhat nauseating, should not be given until digestion is almost or entirely completed. If taken but once a day, they are best given at bedtime.

10. As a general rule, give a mouthful of water after all medicines.

Pills.—If difficulty is experienced in swallowing pills, the addition of a small bit of bread to its bulk will usually remove it, or the pill may be disguised in preserved fruit for children. Pills should be placed far back on the tongue and followed at once by a little water.

Powders.—Effervescing powders or crystals are dissolved in cold water (usually at least one-half tumblerful) at the bedside and taken during effervescence. Powders, such as trional and sulphonal, may be dissolved in water or hot milk before giving, but are usually given dry on the tongue and followed with a drink of water. Bismuth and calomel are insoluble in water, phenacetin and acetanilid nearly so. These are best given dry on the tongue, to be followed with water. Carbonate of ammonia and iodid of potassium may be given in milk. Capsules, pills, and tablets are given from a spoon, followed by water.

Oils.—The disagreeable taste of oils may be lessened in various ways. Castor oil may be given to children in hot milk or a little coffee. Whisky, wine, grape-juice, and orange or lemon flavor are favorite vehicles.

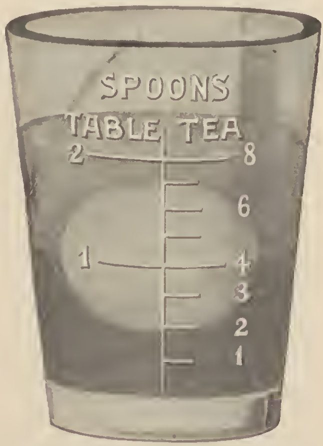

Fig. 104.—Castor oil in glass ready for administration (De Lee).

It is better to moisten the sides of the glass with the wine or diluted juice, pour a couple of drams in the bottom of the glass, drop the oil carefully in the center, add another dram of the juice, and direct that it be swallowed quickly. A powder composed of gum arabic, licorice, and lactose, flavored with vanilla, is used as a disguise for oils in general in some hospitals. It is stated that a small amount of this powder shaken with a little water produces a persistent froth, which forms a very effective disguise for any oily substance. Ice-water, with a few drops of peppermint, taken before and after medicines helps to dull the sense of the taste.

Turpentine and *croton oil* are best given on sugar, from a spoon, followed by water.

Fluid Medicines.—1. It is a general custom to dilute with water most fluid medicines, but judgment should be exercised as to the amount of water that is added. It is unnecessary to prolong the unpleasantness of a disagreeable dose by adding too much water.

2. It is a safe rule to shake all bottles before measuring the dose. In a great many mixtures the important part of the remedy is in the form of a sediment, the liquid being simply the vehicle used to convey it.

3. Bottles should be carefully corked after the dose is measured. Many medicines contain substances that readily evaporate.

4. The regular graduated glasses and dropper should be used to measure. Spoons vary in size and are most unreliable measures.

5. When minims are ordered, they should be measured in the minim glass. Minims and drops mean very different quantities in many medicines.

6. Measure exactly. Never guess at doses of any medicines. A great many nurses, who measure other medicines very carefully, guess at doses of whisky or brandy, and often twice the quantity intended is given. Hold the glass on a level with the eye when measuring.

7. Always pour from the side of the bottle opposite the label. This is a well-known rule that is often disregarded.

8. Give iron through a tube, as it discolors the teeth. If no tube is obtainable, and it has to be given without, allow the patient to brush his teeth with a solution of soda bicarbonate and water afterward.

9. A little ice held in the mouth before a disagreeable dose helps to dull the sense of taste and renders it less unpalatable. Vichy or seltzer are excellent for removing a disagreeable lingering taste.

10. Always keep a separate glass for very strong-smelling substances, such as cod-liver oil.

General Precautions.—Familiarity with drugs is apt to lead to carelessness in handling and using, unless em-

phatic teaching and instructions are given. Drug accidents in hospitals are, unfortunately, not rare. Deaths from wrong doses do occur, not because nurses have not been taught correct methods, but because they are not sufficiently careful. If the following general precautions regarding all drugs are observed, accidents from wrong doses will rarely, if ever, happen:

1. Remember that there is an element of danger in every drug.

2. Read your orders very carefully and be sure that you understand them. A great many omissions and blunders occur from neglect to read orders or from a hasty, careless reading.

3. Never give or use a drug of any kind that is not plainly labelled.

4. Never give a drug in the dark or in a dim light. Neglect of this precaution has caused numerous accidents.

5. Always read the label twice before pouring out the dose and again before giving it. Violation of this rule is the most frequent cause of deaths from wrong doses.

6. Keep your mind on the work in which you are engaged.

7. Measure the dose accurately. Give no more and no less than the order calls for.

8. Never give a pill, capsule, or tablet that has accidentally been spilled or escaped from its container.

9. Never give a medicine which you have a shadow of a doubt about. If you are not sure, and there is no one at hand to inquire of, it is better to omit the dose.

10. Never jump at conclusions regarding fractional doses. For instance, do not give two $\frac{1}{30}$-grain tablets of strychnin because $\frac{1}{60}$ is ordered, and you happen to know that twice 30 are 60. Stop long enough to calculate how much $\frac{2}{30}$ grain really is. Innumerable accidents have occurred with tablet medicines in this way because of mistakes in arithmetic.

11. Give the medicine on the hour it is ordered. If several patients are to be given medicine at the same hour,

begin shortly before the hour, so that all may have their medicines at the appointed time.

12. Be exceedingly careful to see that the doses of medicines for the patients in a ward are not given to the wrong patients.

Verbal orders given by physicians to pupil nurses regarding drugs should always be at once written down, and should never be carried out unless passed on by the resident physician or head nurse.

Sleep-producing Medicines.—Practically all sleep-producing medicines are ordered conditionally. There is a subtle danger in every one of them that is recognized by all who have had experience, and they are regarded as emergency remedies to be given if the need is imperative, and after ordinary simple measures to secure sleep have been tried and proved unsuccessful. When it is necessary to give them, have the patient ready for sleep, treatments all attended to, bed thoroughly comfortable, temperature of the room right, visitors excluded. If these have to be attended to after the dose has been given, it may have lost its effect before the patient is allowed to sleep.

Giving Medicines to Children.—In the case of children who lie in a half-unconscious condition, it is impossible to give medicines in the ordinary way. Much can be accomplished in these cases by using a medicine-dropper and taking plenty of time. The mouth and teeth can be held open slightly and the medicine slowly dropped in. Usually, with children, it is sufficient to insert the dropper beside the teeth, and when the contents are slowly dropped they will usually be swallowed.

Each sick child is more or less of a problem, but there are a few general principles that apply to children as a class. Sometimes firmness and insistence on being obeyed will be all that is needed in giving medicine. When that fails, bribery of some form will often succeed. It is not good moral training to bribe a child to do what he manifestly should do without bribery, but sickness is not the time to teach good habits. If a child is persistently ob-

stinate, it is unwise to spend time in pleading or arguing. The last resort in such cases, if it is important for him to get the medicine, is to hold the nose and give the medicine. Wrap a bath-towel about the body to confine the arms, hold the nose gently, and when the mouth is opened for breathing, insert the spoon as far back in the mouth as possible, empty slowly, and withdraw it. If a child persistently struggles and resists, the matter is one to be reported to the physician. Very often the struggle and consequent exhaustion will overbalance any good the medicine might do.

In giving medicine to young babies, press the chin backward and downward with the finger, and the mouth will usually be opened sufficiently to pour in the medicine gently.

Alcoholic stimulants should be diluted eight times before administration to children.

Belladonna often causes a temporary rash, but is not necessarily injurious on that account.

Bromids and *chloral* are best given to children by the rectum. As a rule, children do not bear opium, iron, or acids well. Calomel, quinin, bromids, chloral, and alcoholic stimulants are usually well borne. The iodids, bromids, and arsenic are apt to cause an eruption resembling acne. Occasionally chloral and quinin will cause a reddish rash.

Delirious Patients.—In cases of low-muttering delirium and semistupor, the medicine will usually be swallowed if slowly introduced well back in the mouth. If the delirium is of a violent, resistive type, two nurses will usually be necessary, one to control the patient's movements, the other to give the medicine. The teeth can be forced open and held apart (a clothespin or toothbrush handle are often used for this purpose) and the medicine can be slowly dropped well back in the mouth. The subcutaneous route is preferable, as far as possible, in these cases. Occasionally, less resistance will be offered to administration by rectum than by mouth.

Insane Patients.—With some insane patients no difficulty is experienced in giving medicines. They take with pleasure the most disagreeable doses and ask for more. Others obstinately refuse everything that is offered when they badly need them. Three questions then present themselves: Is it better to omit the medicines altogether, to use force, or to try to deceive the patient into taking them? Deceiving the patient is rarely recommended and usually fails, especially if the medicine has to be continued for any length of time. It may succeed with a single dose. Introducing the drug into the food may cause him to refuse food when nourishment is of the utmost importance. Delusions that food is being poisoned are common, and this method should never be used with such cases. As a general rule, it is better to be open and frank and admit that the dose is medicine. Tact will often accomplish much in these cases and patience is a prime necessity. Force should not be resorted to. In these, as in delirious patients, the hypodermic method is often preferable where it can be used.

CHAPTER XXX

MEDICINES AND THEIR ADMINISTRATION (*Continued*)

Rectal Medication.—The rectum is used as a means of administering medicines in case of inability to swallow, also when the stomach is easily irritated, and is frequently preferred to other methods in dealing with sick children.

Absorption by the rectum is slower than by the mouth. Much care and judgment needs to be used in giving medicines in this way. The rectum is easily irritated, soon becomes intolerant, and, unless properly given, medicines are liable to be rejected.

In the hands of a skilled nurse, who is careful of every detail that may effect the retention and absorption of

the remedy, rectal medication and nutrition may sometimes be continued without difficulty for some time, but no method of giving medicine requires more skill and care than this.

General Rules.—Remedies for administration by injection into the rectum require to be incorporated in some solution. The temperature should be about 100° F., if

FIG. 105.—Rectal irrigator. A simple funnel will answer as well (De Lee).

the remedy is to be retained. As a rule, 2 ounces are as much as is likely to be retained and absorbed by the rectum. A larger amount can be given if carried up into the colon. The rectum should be free from mucus or feces before giving the medicine. If there is irritability of the rectum, it should be relieved before the injection is given. Time should be allowed for the complete ab-

sorption of one dose before another is given. Fats and starches are rarely absorbed from the rectum, and it should be remembered that fat, by forming a coating over the mucous membrane, may prevent absorption of other substances. Alcohol, if frequently used, is liable to cause irritation.

Opium in the form of laudanum is occasionally given as an aid to retention. When used, the minimum dose that will produce the desired effect should be given, as it prevents absorption.

Position.—The best position, if the medicine is to be absorbed from the rectum, is on the left side with the hips elevated. If the medicinal fluid is to be carried up into the colon, the right side is preferable. The reason for the change in position is the abrupt turn in the course of the bowel. The reason for choosing the left side in the first place is that the fluid may by the natural force of gravity follow the course of the bowel to the left. After the sigmoid flexure is passed, the colon is arranged like the three sides of a square. It follows that if the left side is chosen for the introduction of fluids that are to be absorbed from the rectum, then the back or the right side is preferable when the fluid is to be absorbed from the colon, otherwise the fluid is forced to make progress against the force of gravity. The fluid will thus have a tendency to flow backward, distend the lower bowel, and be more quickly rejected.

When the condition of the patient permits, the knee-chest position is recommended, especially in dealing with nervous or hysteric patients and when a large amount of fluid is to be given. All fluids, to be retained, should be given slowly, and the tube inserted and removed very slowly and gently. Glycerin should not be used as a lubricant. Care should be taken to avoid air entering the bowel. A folded towel pressed against the anus after the tube is withdrawn is an aid to retention.

Suppositories as a means of rectal medication are used chiefly for the relief of pain or as a local antiseptic in case

of rectal ulcers or following rectal operations. Occasionally glycerin is used in the form of suppositories as a laxative. The suppository is intended to melt at body temperature, and if stored near a heated radiator or chimney will quickly loose shape and be unfit for use.

Having lubricated the suppository, it should be very gradually inserted into the rectum. It is less likely to be immediately rejected if it is passed well up beyond the sphincter muscle, using the index-finger covered with a rubber finger-cot or a small smooth instrument for that purpose.

Hypodermic Injections.—The introduction of medicines by hypodermic injection is resorted to when rapid action is desired and in case of irritation of the stomach.

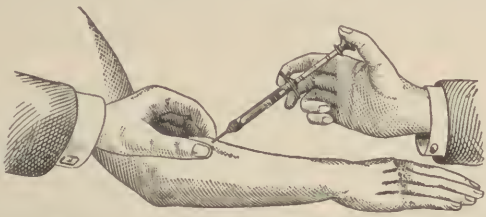

FIG. 106.—Method of giving a hypodermic injection (Thornton).

Usually powerful drugs in concentrated form are given in this way. All such drugs are made with special care under aseptic precautions, and care should be used to keep them as pure as possible.

Morphin, atropin, codein, strychnin, digitalis, nitroglycerin, and a few other drugs are prepared in tablet form for hypodermic use, while ergot and adrenalin are in fluid form.

To give these injections a hypodermic syringe is needed, which also should be made as nearly aseptic as possible before use. The hollow needle should be kept in good condition, so that it is neither blunt nor the opening blocked. All needles should have the wire inserted after using. The washers, if there are washers, should not

be allowed to dry up. Before using, the needle should be sterilized. A convenient method is to boil in a spoon for two minutes in a little water, first wrapping the needle with a bit of absorbent cotton. This provides at once a sterile spoon in which to dissolve the tablet and also the sterile water needed. The needle is removed and sufficient water drawn from the spoon into the syringe to dissolve the tablet. The spoon is then emptied, the tablet placed in it, and the sterile water from the syringe poured on it to dissolve it. All particles of the tablet should be dissolved before injecting it. About 15 minims is an average quantity of water to use.

The parts of the body selected for the injection are usually the outer surfaces of the thighs, legs, or arms. Female patients usually prefer that the legs be used, as it may leave a scar on the arms. Bony prominences, parts on which there is liable to be much pressure, the exposed parts of the body, and proximity to blood-vessels are to be guarded against. The part selected should first be cleansed by rubbing with alcohol, using a clean gauze or cotton sponge. A piece of the muscle is picked up with the left hand. The air is expelled from the syringe by pushing on the piston point till a bubble appears at the point of the needle. It is then inserted quickly in an oblique direction deep into the tissue, slightly withdrawn, and the fluid injected. Pressure with a clean sponge should be made for a moment over the opening. The syringe and needle are then cleansed by using alcohol or carbolic acid solution and the wire replaced in the needle.

Inhalation.—Medicines are given by inhalation, both for local effect on the air-passages and for systemic effect. The drugs most frequently given by inhalation are chloroform and ether given for anesthetic purposes, but the administration of these drugs is out of the province of the first-year pupil nurse.

Steam inhalations are given to children in cases of croup, bronchitis, diphtheria, and often in pneumonia. They are frequently used for the relief of the congestion caused

1

2

Croup-tent for steaming and calomel-fumigation (Northrup): 1. Croup-tent open. The fumigation-apparatus, standing on the table, consists of a Bunsen burner, a tripod, and a plate containing calomel. 2. Calomel-fumigation: croup-tent closed, nurse watching the child while fumigation is going on.

by a "cold in the head." When needed for the latter purpose, a pitcher of boiling water and a small blanket or bath towel will be needed. The medicine is poured into the boiling water. The head is held over the vapor and the blanket wrapped around all to confine the steam.

Croup Tent.—Where it becomes necessary to keep the atmosphere moist continuously, a croup tent is employed. The steam is generated in a kettle on a gas or oil stove, or electric heater, close to the bed. A tent is formed over the bed with a sheet. The steam is conducted from the spout of the kettle under the tent by means of a long cone or tube made of stiff paper.

Dry inhalations are required occasionally for the relief of asthma. Various narcotic substances are often incorporated in the form of cigarettes. Occasionally dried leaves or herbs are burned. The leaves can be placed in the bottom of a deep cup and a paper or pasteboard cone fitted over it, having an opening in the center, through which the vapor is inhaled.

Oxygen is administered by inhalation when for any reason the patient is unable to inhale sufficient from the atmosphere for the immediate needs of the system.

It is a valuable but expensive remedy, the methods of administering which all nurses should become familiar with. Oxygen is contained in steel cylinders which vary in size and general mechanism. The principle on which the oxygen outfits are arranged is practically the same, though the appearances differ. The stop-cock which controls the flow of gas is sometimes a wheel, in others a handle. Usually in large cities the drug firm supplying the oxygen will either send definite directions as to the regulation and use of the apparatus or send an agent to adjust it if necessary. The oxygen is passed through a bottle containing water, which serves as a guide in computing the amount consumed and in regulating the flow. The cylinder containing the oxygen is placed close to the bed. A long rubber tube connects it with the oxygen bottle. The bottle should have a fairly wide mouth with

a rubber stopper. Two holes are made through the stopper, through which two bent glass tubes are inserted, one slightly longer than the other. The rubber tube connected with the faucet is fastened to the longer of the glass tubes, which should project well into the water. Another rubber tube attached to the shorter glass tube conveys the oxygen to the patient by means of a glass or hard-rubber nozzle

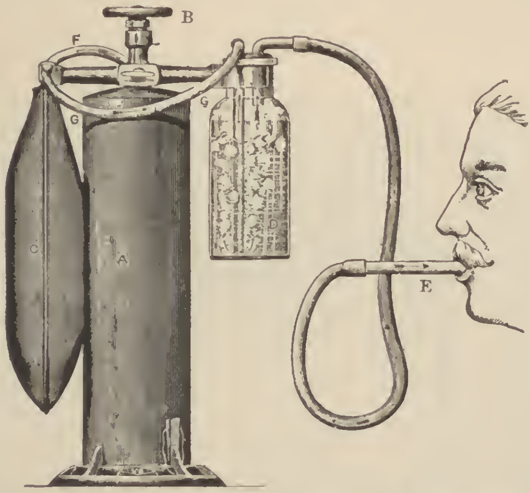

FIG. 107.—Inhalation apparatus of the S. S. White Dental Manufacturing Company: A, represents the cylinder filled with compressed oxygen; B, the gas valve; C, a rubber bag, holding one gallon; D, a wash-bottle half filled with water; E, a mouthpiece attached by a rubber tube to a short glass tube which passes through the cover of the bottle, but does not extend down to the surface of the water; F, a rubber tube connecting the rubber bag and the valve B; G, a rubber tube connecting the bag with the wash-bottle by means of a glass tube which extends through the cover nearly to the bottom.

held in the mouth; or it may be preferable to fit a funnel to the end of the tubing instead of the nozzle, and allow the oxygen to be diluted with air before being inhaled. The bubbles formed as the oxygen passes through the water will indicate the flow. The stop-cock should be turned on very slowly and the volume increased very gradually. It should be regulated till only very small

bubbles are produced. Bungling in the management of the flow of the gas may result in great waste. The physician will give definite directions as to how long the inhalations are to be continued, and the faucet should be tightly closed the moment the inhalation ceases.

The oxygen outfit has become a necessity in the modern practise of medicine, but it should not be necessary to remind a nurse that the natural method of securing the

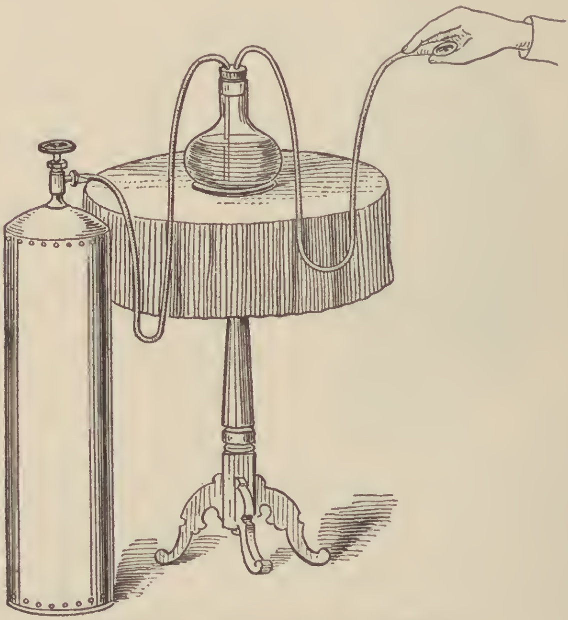

FIG. 108.—Beseler oxygen apparatus.

oxygen for the patient is the most desirable. To shut out the natural supply of oxygen by closed doors, windows, and ventilators, and then try to restore the patient by artificial means is an absurd proceeding.

Amyl nitrite is another emergency remedy usually given by inhalation. The drug is prepared in thin glass globules called pearls. Each pearl contains 3 or 5 minims, and

usually one pearl is considered a sufficient dose. The pearl is crushed in a small towel or handkerchief and held over the nostrils. It is used in heart failure from anesthetics, to relieve the spasms of tetanus, angina pectoris, and, occasionally, in convulsions.

Camphor is another drug often given by inhalation, the drug being dropped on a napkin or inhaled from a bottle.

Applications to the Eye.—The eye lotion is used either in the eye-bath or by dropping into the eye. In the eye-bath the solution is used as hot as can be borne. The

Fig. 109.—Method of syringing eye. The cotton held against the nose should prevent any infection of other eye (McCombs).

eye is submerged in a small glass filled with the solution. The average duration of the eye-bath is five minutes for each eye. Simple inflammation of the eyes from dust or other irritation is often relieved by an eye-bath in water without the addition of drugs.

In dropping medicines into the eye the patient should throw the head back as far as possible or lie down and look upward. The lower lid is drawn slightly downward and the medicine dropped in the inner corner of the eye.

The lid should not be closed or the lotion will be forced out. The eyeball should be slowly moved about to diffuse the fluid over the whole eye.

In washing away a discharge from the eye, the solution should be applied at the corner of the eye nearest the nose, and the discharge always wiped away from the other eye, never toward it. In using a syringe to cleanse the eye, hold a piece of cotton as protector over the other eye.

When it becomes necessary to apply medicine to the lining membrane of the eyelids, the lids must be turned outward. The upper lid is everted by directing the patient to look downward, gently grasping the lid, drawing it down, and rolling it back on itself. If difficulty is experienced, a toothpick or similar instrument placed across the eyelid before it is rolled outward and back will make it easier.

To expose the lining of the lower lid the patient should look upward while the lower lid is drawn down. In this way foreign bodies can be easily seen and removed.

Mydriatics are drugs which dilate the pupil of the eye. Those most frequently used are atropin, belladonna, duboisin, and cocain.

Myotics are drugs which cause contraction of the pupil of the eye. Eserin is the one chiefly used in ophthalmic work. Opium, pilocarpin, carbolic acid, internally, and anesthetics at the last, all have the effect of contracting the pupils. Strychnin is said to increase the sensibility of the eye and render the vision more acute.

Giving Medicine Through the Skin.—Medication by simply placing the drug in contact with the skin is used mainly for producing counterirritation or for soothing purposes when the skin is irritated, as in sunburn, slight burns, etc. Tincture of iodin and mustard, in the form of paste or leaves, are common examples of the former, and cold creams, ointments, etc., of the latter.

Inunction.—The introduction of medicines through the skin by means of friction is a common method of administering oils, liniments, and ointments. Where inunction

is ordered for systemic purposes, it is usually applied to the inner surface of the thigh or arms and to the axillary area, from which absorption is more rapid than from other parts of the body. Where inunctions are ordered to promote nutrition in infants, olive oil is commonly used, and the whole body gone over. The skin can only absorb a certain quantity, and care is needed to avoid applying an excess of the oily substance.

The *fly-blister* is a remedial agent that is not often called for, but its use has not entirely been abandoned. Many physicians still prescribe it for cases of meningitis, pleurisy, diseases of joints where there is effusion, and for chronic pain in different parts of the body. It is said to be of value for four purposes: "To counteract inflammation or congestion; to cause absorption of inflammatory deposits after inflammation has ceased; to relieve chronic pain; and for general effects on the system in certain constitutional diseases."

It is not always applied directly over the seat of the inflammation, but rather with reference to the nerve endings. For instance, in intercostal neuralgia the blister is frequently applied over the vertebra, where the affected nerve makes its exit. The exact location and area to be covered by the blister should be definitely ascertained from the physician.

The part should be cleansed and shaved if there are any hairs to be seen. The blister, cut the exact size, can be secured in place by a bandage. The blister should rise in from four to seven hours, but occasionally, where the skin is very thick, it takes longer. The application of a hot poultice to the part after the blister agent has been removed will sometimes be necessary in those cases. The blister should be carefully watched and removed gently at the time ordered. Sometimes the fluid in the blister is allowed to remain undisturbed to be reabsorbed, but the customary method is to make a slight incision at the lowest point, allow the watery fluid to escape, and apply a simple unirritating dressing. Cantharidal col-

lodion is a blistering agent which is applied by painting on, as with tincture of iodin.

Insufflation is a method used in applying powders to various parts of the respiratory tract by means of a rubber bulb attached to a receptacle containing the powder. Its use is confined mainly to the nose and throat. The atom-

Fig. 110.—Method for syringing ear with fountain syringe. The lower end of bag should not be above level of auditory canal (McCombs).

izer or spray is used for treating the same parts of the body with fluids.

The **douche** is a common method of applying medicated substances in solution to the mucous membrane of various parts of the body. Its chief uses are to check hemorrhage, to relieve pain, to check secretions, to cleanse, and to stimulate.

The *nasal douche* is occasionally used, but it has very limited utility. Only a small part of the mucous membrane of the nasal passages is reached in this way. The

Fig. 111.—Method for syringing nose. The syringe is introduced into upper nostril, the solution escaping from opposite nostril or mouth (McCombs).

ear douche, the vesical, vaginal, rectal, and colonic douche are all valuable therapeutic agents, the correct technic of which should be understood by every nurse.

CHAPTER XXXI

EVACUANTS AND INTESTINAL ASTRINGENTS

Evacuant is a term used interchangeably with cathartic or purgative. It has, however, a broader meaning. Some medical writers have used it in grouping together emetics,

cathartics, anthelmintics, and diuretics, while Webster defines evacuation as the "voidance of any matter by the natural passages of the body or by an artificial opening, also a diminution of the fluids of an animal body by cathartics, venesection, or other means." In the study of special drugs it may be well to begin with the common evacuants and the general remedies which are used for increasing the activity of the bowels, urinary system, and the skin.

Cathartics are remedies used to increase the peristaltic action of the bowels. Of these there are various subdivisions.

Laxatives or aperients are cathartics having a mild action, exciting moderate peristalsis, and producing softened stools without irritation. In this class there are many simple natural remedies which all nurses should be familiar with, the use of which will often be left to the nurse's judgment. Drugs should not be used when natural remedies will accomplish the desired result.

The **normal condition** regarding bowel movement is that each individual should have at least one evacuation of the bowels each day. There are various deviations from this rule in the way of increased movement, which up to a certain point do not affect the general health, but if at least one bowel movement does not take place each day the health is sure, sooner or later, to suffer from retention of waste products in the system.

Habit is a strong controlling factor in this matter, and an effort to empty the bowel at a regular time each day should be made until the habit is established.

Water.—Copious drinking of pure water tends to promote the normal action of the bowels, but too much water should not be used at meals. For laxative purposes, a glass of either hot or cold water, with or without the addition of a pinch of salt, taken on rising in the morning, proves a sufficient remedy in a great many cases.

Food.—The character of the food also has a decided action on peristalsis. A great many vegetables have

a tough woody fiber which, though indigestible, performs a useful function in contributing to the bulk of food needed, and thus stimulates peristalsis. Of these, green corn and turnips are examples. Coarse cereal foods, such as hominy, oatmeal, and crushed wheat, brown bread, and bran biscuits, all have a slight laxative effect. The addition of cream to an infant's food will often correct any tendency to constipation.

Fruits act as laxatives through their seeds and through the action of the acids and salts they contain. For laxative purposes fruits should be eaten between meals and on rising in the morning. The laxative action is increased if the fruit is followed with a glass or two of water. Preserved fruits are not so effectual as fresh, and bananas are said to cause constipation. The following list of fruits have a laxative effect: Prunes, oranges, grapefruit, apples, cooked or raw, peaches, berries.

Buttermilk, apple cider, koumiss, honey, rhubarb, walnuts, almonds, and fresh green vegetables are all useful articles of diet when there is a tendency to constipation.

Exercise.—Active exercise of the body tends to promote the normal action of the intestines. Those who lead a sedentary life or are confined to bed require that special care in diet be used if constipation is to be avoided.

Massage of the abdomen is used with especial benefit in children, where natural simple measures are not sufficient to produce a normal action of the bowels. Begin at the right groin and follow the course of the colon around the abdomen.

Simple purgatives are used to secure active peristalsis. Usually these produce one or more free semifluid movements, with, occasionally, griping and irritation. Common examples of this class are cascara, castor oil, olive oil, calomel, licorice powder, compound rhubarb pills, and aloin, strychnin, and belladonna pills, of which there are a number of varieties. The ordinary soap-suds enema would also come in this class.

Castor oil (*oleum ricini*) is one of the best and most

nauseous of the simple purgatives. It is obtained from the bean of the castor-oil plant. It is regarded with favor partly because of its bland, soothing, unirritating qualities, making it a very desirable purgative for infants and aged people, also where the intestinal tract is already irritable from the presence of putrid food, and in diarrhea or dysentery.

Olive oil (*oleum olivæ*) is a nutritive food having a laxative effect. It is used extensively as a salad dressing, but the taste for it as a food has to be acquired. It is a good laxative for infants and for poorly nourished adults. It is frequently used by injection into the rectum to soften fecal discharges and is a valuable intestinal remedy in cases of dysentery and inflammation of the colon with a mucous discharge. Adulteration of olive oil is frequent, cotton-seed oil being used extensively for this purpose. Olive oil is obtained from the fruit of the olive tree. Much of the best olive oil is imported from Italy, but adulteration is so common that in many preparations the less expensive cotton-seed oil is directed to be used.

Cascara (*rhamnus purshiana*) is a very mild cathartic, especially valuable in constipation. It does not cause constipation afterward, as do many other cathartics. In small doses it has a non-irritating tonic action on the intestines. There are various preparations which differ markedly in potency.

Compound licorice powder (*pulvis glycerrhiza compositus*) is a mixture of senna, sulphur, licorice root, and other ingredients. Senna is the most active ingredient. It resembles castor oil in its action and is more agreeable to take. It is given mixed with a little water and should be followed by a larger quantity of water.

Calomel (*hydrargyri chloridum mite*) is frequently given combined with some other drug, usually soda bicarbonate. If taken alone it is slow in action, and small, oft-repeated doses are considered preferable to one larger dose in a great many cases. It is considerably used as a remedy for children in cases of digestive disorders, foul breath,

jaundice, etc. In large doses or if long continued it is apt to produce salivation. It is an important ingredient of the blue mass pill. Both calomel and blue mass are favorite remedies in so-called "biliousness."

(Symptoms of salivation are fetid breath, swollen and spongy gums, sore and loosened teeth, increased secretion of saliva, headache, and insomnia.)

Aloin, strychnin, and *belladonna* pills, in all their numerous combinations, are frequently employed in constipation for their laxative and tonic action. Aloes acts especially on the lower intestine, slightly increases the flow of bile, and does not tend to constipate as an after-effect.

Compound rhubarb pills are a combination of rhubarb with aloes and oil of peppermint. *Rhubarb* (*rheum*) has a tonic, laxative, and astringent effect, its astringent properties being exerted after its purgative effect. It is considered useful in chronic constipation and dyspepsia for its tonic effect.

Drugs which Produce Watery Stools.—In this class would be placed Epsom salts, Seidlitz powder, citrate of magnesia, and various other concentrated or specially prepared salts; also saline mineral waters, such as those found at Saratoga Springs, New York, in Michigan, Ontario, and various other parts of the American continent.

Apenta, Abilena, Apollinaris, and Hunyadi János are familiar examples of imported mineral waters used for this purpose.

Compound jalap powder, elaterium and croton oil, are more drastic in action, and comparatively seldom used.

Croton oil (*oleum tiglii*) has a powerful and rapid action, and its use is usually followed by a very decided physical depression.

The dose rarely exceeds 2 drops, and often only ½ drop is given. It may be given dropped on sugar or mixed with glycerin.

Elaterium (*elaterinum*) has a powerful action, producing excessive watery stools in a short time. It also is followed

by extreme prostration and stimulation may be needed to counteract the exhaustion. There are two or three preparations of this drug of different potency. The average dose of elaterin is gr. $\frac{1}{20}$.

Jalap (*jalapa*) is used frequently in cases where there is a dropsical effusion, and in cases of sluggish liver. It is one of the ingredients of the compound cathartic pill, and is often combined with calomel. Compound jalap powder is a mixture of one-third jalap and two-thirds cream of tartar.

Epsom salt (*magnesii sulphatis*) is contained in many mineral spring waters. It is produced by the chemical combination of sulphuric acid and carbonate of magnesia. It is given cold, dissolved in water, well diluted, and though disagreeable to the taste, is well borne by the stomach. The dose varies greatly, 2 ounces being about the limit. A favorite method is to give in small doses frequently till the desired action is produced.

Citrate of magnesia (*magnesii citratis*) is a combination of carbonate of magnesia and citric acid. It is prepared both in powder form and in solution, both being effervescent. The granular powder needs to be kept in a dry place, well corked, or its effervescing properties will be lost. The solution should be kept in a cool place and taken as soon as possible after being poured out.

Seidlitz powder is a combination of Rochelle salts, soda bicarbonate, and tartaric acid. It is usually prepared in white and blue papers. The white paper contains 2 drams of Rochelle salts and 40 grains of soda bicarbonate; the blue, 35 grains of tartaric acid. The contents of the papers are dissolved in cold water in separate glasses. Before giving it to the patient they are mixed, which produces effervescence, and the mixture should be taken before the effervescence subsides.

Anthelmintics are agents used to cause the expulsion of intestinal worms. The term is used interchangeably with vermifuge.

Santonin (*santoninum*) with calomel is the remedy most

used for the round-worm that sometimes inhabits the small intestine. This remedy has no effect on the tapeworm. If the calomel is not effective in producing a bowel movement, it should be followed with castor oil or a saline purgative. Pumpkin seeds are occasionally used when tapeworm is suspected.

Vermicides destroy intestinal worms. For threadworms and round-worms solutions of alum, salt, limewater, and quassia are often given by enema.

Carminatives assist in expelling gas from the stomach and intestines, slightly increase peristalsis, and stimulate circulation. They exert a soothing and relaxing effect on the tissues. Common examples are peppermint, ginger, capsicum, and cardamom. Asafetida is given both in pill form and solution. When used in enemata, the milk of asafetida is given. Turpentine is given by mouth, combined with other drugs, or by enema, for this purpose.

Intestinal astringents lessen the discharges from the bowels, contract tissue, including the walls of the intestinal blood-vessels, and diminish the fluids of the intestines.

Bismuth subnitrate (*bismuthi subnitras*) and *carbonate* are the drugs chiefly used for this purpose. Bismuth blackens the stools and has also a sedative action on the stomach in case of vomiting. It is insoluble in water and is usually given dry on the tongue, followed by a drink of water. When giving it to infants and small children it is usually suspended in some fluid medicine or given in milk.

Alum (*alumen*) is used locally as an astringent by injection into the rectum and colon. It forms a precipitate with a great many drugs, and is usually given alone or dissolved in water. In too large doses it is a poison producing inflammation of the gastro-intestinal tract and death. Alum solutions for enemata should be measured with care. Even a mildly strong solution will sometimes act as a powerful irritant to the intestinal tract, and cause intense pain and griping.

Tannic acid (*acidum tannicum*) is a powerful astringent which contracts tissue, impairs digestion, and checks bowel discharges. It is used internally in pill or powder form, and locally to the rectum and colon by enema. It is contained in witch hazel and many other astringent remedies, and is frequently used to harden the skin on parts of the body where much friction occurs.

Silver nitrate (*argenti nitras*) is used as an astringent either in pill form or solution by enema. It is used in typhoid fever to some extent, in chronic dysentery, and chronic inflammation of the colon. It is easily decomposed, and its value in pill form is questioned because of the changes effected in it by the stomach contents.

Solutions should be freshly made with distilled water. Any animal or vegetable substance entering into the solution tends to decomposition. It should be kept in a dark place. Only glass stoppers should be used for bottles.

Opium is used to a considerable extent as an intestinal astringent and is frequently employed in combination with other drugs, such as lead acetate or camphor, in checking diarrhea or dysentery.

Tincture of opium (*tinctura opii*) or laudanum is given internally in doses of from 5 to 20 minims. A somewhat larger dose is sometimes given by enema, but it needs to be used with great caution, and the symptoms of overdosing or poisoning should be well known.

Laudanum is frequently given by enemata, a thin solution of common laundry starch being used as a vehicle. About 3 ounces of starch is sufficient, and if given for diarrhea, the solution should be almost cold.

Camphorated tincture of opium (*tinctura opii camphorata*), or paregoric, contains, beside powdered opium, benzoic acid, camphor, glycerin, alcohol, etc. The dose for an infant is from 1 to 15 drops, depending on the age and condition of the child. Children, as a rule, do not bear opium well.

CHAPTER XXXII

EMETICS, DIURETICS, AND DIAPHORETICS

EMETICS

Emetics are agents that cause vomiting. They are used to quickly remove food or drugs causing irritation in the stomach; to expel an excess of bile from the gall-bladder; and to facilitate the expulsion of excessive secretion or false membranes obstructing the air-passages.

Emetics are of two classes—those having a local and a systemic action.

Emetics Having Local Action.—Common examples of the first class are tepid water in quantity (2 to 4 glasses); salt solution; mustard and water; powdered alum; putting the finger down the throat.

Salt (*sodium chlorid*) solution may be given warm, using as much salt as the water will dissolve.

Alum (*alumen*) may be given in ½-teaspoonful doses for a child and a teaspoonful for an adult. Mix well with honey or syrup.

Mustard is given in doses of from ½ to 1 teaspoonful for a child and double the quantity for an adult, stirred in a glass of warm water, and quickly swallowed. It may be followed with copious drinking of tepid water.

Emetics Having Systemic Action.—Common examples of emetics having a systemic action are ipecac and apomorphin. These have a certain local action also, producing an irritation of the nerves of the stomach, as well as of the vomiting center. Opium and many other drugs produce vomiting as an after-effect.

Syrup of ipecac (*syrupus ipecacuanhæ*) is a favorite remedy in cases of croup and capillary bronchitis in children. A teaspoonful of the syrup may be given and repeated in fifteen minutes. It is slow in action, but is considered a safe, non-depressant remedy.

Apomorphin acts rapidly and directly on the vomiting

center. It is a powerful heart and respiratory depressant in large doses. Is usually given hypodermically. The dose varies from $\frac{1}{10}$ to $\frac{1}{40}$ grain.

DIURETICS

Diuretics are remedies which increase the secretion of the urine. They are used:

1. To dilute the urine.
2. To stimulate the kidneys.
3. To promote the elimination of waste matter and poisonous substances from the body.
4. To carry out of the body the excess of fluid in dropsical conditions.

Water is regarded as the best of all diluents for the urine. Many mineral waters are prescribed for this purpose, not because of the mineral constituents, but in order to induce the patient to drink enough water to thoroughly flush out the system.

When the urine is highly acid, some benefit may be secured from the use of alkaline mineral waters, such as Vichy.

Potassium bitartrate (*potassii bitartras*), or cream of tartar, is classed as a refrigerant diuretic. It is most effective when given well diluted with water. A favorite old-fashioned method of giving it was in the form of cream-of-tartar lemonade.

The prescribed amount of the drug was dissolved in hot water. When cold, the clear solution was poured off, and sliced lemons and lemon-juice were added with sugar, to make it a palatable drink. The patient was directed to drink freely of it. This is popularly known as "Imperial Drink."

Potassium citrate (*potassii citras*) is an alkaline remedy much used as a diuretic. It is a deliquescent drug, and may liquefy by absorption of moisture from the atmosphere. It is given largely diluted with water.

Digitalis acts as a diuretic through its action on the general and renal circulation. It is said to contract the

blood-vessels of the body and to dilate the arteries of the kidneys, thus increasing the blood-pressure; is frequently used in congestion of the kidneys and cardiac dropsy.

It is irritant to the stomach and bowels, has a cumulative action, and slows the pulse. It is sometimes used in the form of a poultice applied over the kidneys—hot water being poured on the digitalis leaves.

Infusion of digitalis is made from the leaves. It rapidly decomposes and should be freshly made in small quantities.

Digitalis has two active principles—digitalin and digitoxin—which are given hypodermically in tablet form; dose, gr. $\frac{1}{100}$ of either.

Other preparations of digitalis are extract of digitalis, given in pill form; fluidextract of digitalis; tincture of digitalis.

It is important that the patient be kept absolutely lying down when digitalis is being given. Digitalis is an active vegetable poison, and deaths from overdosing have occurred.

Diuretin is used as a diuretic in case of dropsical effusions. It is said to occasionally cause diarrhea, but does not appear to irritate the stomach.

Urotropin acts as a urinary antiseptic, increases the amount of the solids in the urine, and the flow. Urotropin is the trade name for a common drug which can be more economically purchased under the name hexamethylenamine (the Pharmacopeial name).

Caffein has an action resembling digitalis in its effect on the heart, but its effect is produced more rapidly and is more transient. It acts as a stimulant to the kidneys. The citrate of caffein is a preparation that is very frequently used. An effervescent preparation is also made. It sometimes produces marked nervous symptoms, even after comparatively small doses.

Fruits, fish, and **milk** are said to increase the alkaline reaction of urine by the salts they carry into the system.

DIAPHORETICS

Diaphoretics increase the action of the skin and produce perspiration.

The first and most natural remedies for this purpose are heat and water. These may be secured by means of hot air, hot baths or packs, hot drinks, and by the free use of hot-water bottles, bricks or hot irons, and plenty of blankets.

Heat has the effect of dilating the capillaries and stimulating the sweat-glands. In using hot-air or hot-water baths for this purpose, attention must be paid to the smallest details. What may seem a trifling carelessness may be sufficient to defeat the entire purpose of the treatment or cause very undesirable after-effects.

In a great many hospitals there are now hot-air machines or boxes, in which the whole body or a limb is subjected to a high degree of dry heat. In some of these hot-air outfits the heat is produced by rows of electric-light bulbs arranged in a closed cabinet. This method gives the combined effect of the light and heat.

In others the limb and sometimes the whole body is placed in a specially constructed hot-air cylinder, the heat being produced by alcohol or gas. A very much higher degree of dry heat can be borne than of moist heat without burning. A special high-registering thermometer is used to record the temperature, which is raised very gradually and carefully regulated. The body or the part needs to be carefully and evenly wrapped or protected, and anything in the form of oil or ointment should be removed before covering the part. Very bad burns have resulted from neglect of these precautions.

No patient should be left alone during one of these treatments. The condition of the pulse should be closely watched.

To *give a hot-air bath in bed* a body cradle is placed in the bed. The sheet is covered by a mackintosh and this by a blanket and the patient's clothing is removed. The hot air may be secured by means of a portable coal oil or gas stove at the foot of the bed and conducted by means

of a pipe under the cradle. Over the cradle is placed a heavy blanket or thick quilt and a large rubber sheet. These are tucked snugly in all around to prevent the escape of air. The temperature may range from 100° to 150° F. in such treatments. If a steam bath is given, the temperature should not be allowed to exceed 112° F.

The duration of such baths is ordered by the physician. From twenty minutes to one-half hour is the average time. The patient is encouraged to drink freely of hot drinks, but care should be used that the arms are not exposed. Cold compresses or an ice-cap are kept to the head during the bath. After the apparatus is removed the patient should be dried and wrapped in a dry blanket. Great care must be used to prevent chilling after the bath.

For patients who are not confined to bed free perspiration may be induced by a hot-air bath, given in a cane-seated chair. Prepare a hot foot-bath, having the water as hot as can be borne. Let the patient, with clothing removed, sit in the cane or open wicker chair with feet immersed in the hot water. Wrap several blankets around the chair, pinning them together at the neck and in several other places, and having them reach the floor. Burn an alcohol lamp with a large wick under the chair.

Hot drinks of lemonade, ginger tea, or any fluid preferred should be administered freely during the process, and the patient should lie down and be allowed to cool off very gradually afterward.

Hot-water baths and packs will be discussed under Hydrotherapy.

Pilocarpin (*jaborandi*) is the drug principally used as a diaphoretic, when intense and rapid action is desired. The patient should be kept in bed between blankets and dry heat applied.

Pilocarpin is a cardiac and respiratory depressant, and the pulse, respiration, and general symptoms should be closely observed. The dry heat partially combats the general depression and assists in promoting perspiration. The perspiration lasts from three to five hours. The secretion of saliva, also the nasal, bronchial, and lacrimal

secretions are increased. The temperature may be expected to fall from one to four degrees. The depressing effects usually subside in from three to six hours.

Pilocarpin hydrochlorid is prepared in tablet form for hypodermic use. The drug is also used as a fluidextract.

Sweet spirits of niter (*spiritus ætheris nitrosi*) is given both for its diuretic and diaphoretic effect. When given to increase the flow of urine, the patient should be kept cool and the drug given in iced or very cold water. When given to induce perspiration, it should be preceded by hot drinks and the patient kept warmly covered. It should be given well diluted with water. It evaporates rapidly if not well corked and deteriorates with age. Old solutions should not be used. It is used to a considerable extent in expectorant mixtures and to allay feverishness in children.

CHAPTER XXXIII

CARDIAC STIMULANTS AND SEDATIVES

Stimulant is a term which is used in a variety of ways in reference to remedial agents. Its original meaning was a goad, a whip, or lash, used to incite some organ to greater activity.

Diffusable stimulants have a prompt but transient effect on the general functions of the body. To this class belong ammonia, camphor, various smelling salts, and alcohol.

Respiratory stimulants act directly on the nerve centers controlling respiration. Examples—strychnin, ammonia, and belladonna.

Vasomotor stimulants act on the blood-vessels. Examples—nitroglycerin, ether, alcohol, strychnin, digitalis, electricity, and adrenalin.

Cerebral stimulants act on the cerebrum. Examples—alcohol, opium, caffein, tea, etc.

Gastric stimulants act on the stomach. Examples—nux vomica, ginger, capsicum, and the vegetable bitters.

Cutaneous stimulants act on the skin and superficial

vessels and include diaphoretic agents and rubefacients. Examples—turpentine and mustard.

There is no other class of drugs which a nurse will need to use so frequently in emergency, or the use of which will be left so often to be determined by her judgment, as cardiac stimulants, those which act directly on the heart and organs of circulation. No class of drugs is used so promiscuously by the laity unless it be pain-relieving drugs, another exceedingly important group. An English physician (Herbert E. Cuff), in commenting on this condition in a lecture to nurses, says: "In the minds of non-professional people lies deeply rooted the idea that everything which helps 'to keep the patient up' must be good for him. The result is that sometimes a patient is so effectually kept up that he disappears altogether from the scene. A patient does not need stimulants because he is *going to have* a hard fight to pull through. Giving alcohol to a patient merely because he is suffering from a severe illness comes to much the same thing as beating a horse because it has a heavy load to carry. So long as heart and horse are doing their work satisfactorily, we let well enough alone. When they show signs of tiring, then is the time for stimulating them."

Indications for Stimulants.—The term "indication" in reference to remedial agents means the evident demand of the system for a certain remedy.

1. *Shock.*—Mental impressions, fright, etc., or severe pain may cause faintness and general weakness of all the vital functions. Surgical shock, accidents, loss of blood, etc., cause general relaxation, almost paralysis, of the nervous and muscular system.

2. Exhaustion of the heart, shown by weak, rapidly increasing pulse.

3. In cases of profound toxemia with an exhausted nervous system, shown by low muttering delirium, tremor, etc.

4. In cases of extreme debility when all the functions seem to need quickening.

Effects of stimulants widely differ. Most of them are violent poisons when taken in too large doses. The heart

is irritated and made to work harder by many stimulants, but it is not strengthened. The pulse is strengthened because a greater volume of blood is forced into the arteries. A whip does not strengthen a horse. If it did, he might be fed on whips. It helps to incite him to keep going till a certain point is reached. Too much whipping or too much stimulation may produce a collapse of a horse or of the heart. Many stimulants, if too long continued or used in too large doses, cause a poisoning of the nervous system.

Rest.—In all conditions requiring stimulation of the heart, rest is an important factor. Everything that might add to the strain the organ is already laboring under should be avoided.

Heat acts as a general stimulant to the vital functions. The heating of the blood in the superficial tissues of the body increases the action of both heart and lungs. Coldness of the surface of the body is one of the important signs of depression of the vital organs. In case of active hemorrhage, heat is contra-indicated.

Elevation of the foot of the bed increases the supply of blood to the brain, and helps to keep that important organ in condition to do its work. It also helps the heart to force the blood to the vital organs. Bandaging of the legs is also resorted to for similar reasons.

Salt solutions by rectum, hypodermoclysis, or intravenous infusion increase the volume of blood. In many cases requiring stimulation there is too little blood in proportion to the wide channels in which it must circulate.

General effects of salt solutions are said to be:

1. Stimulation of the heart.
2. The red blood-corpuscles undergo regeneration.
3. Arterial tension is increased.
4. Toxic substances in the blood are diluted and their elimination hastened. Usually the kidneys share in the stimulation and more urine is voided.
5. The fluids of the body are increased and the general condition of the patient improved.

Tea and **coffee** contain the alkaloids thein and caffein,

which are said to be identical. The warmth of the infusion adds to the stimulating effect, while the water used in making the infusion adds to the fluids of the body. In certain forms of mental torpor due to toxemia these are useful, their action being chiefly on the nervous system. Green tea possesses more active properties than black.

Meat Extracts.—A great many extracts and essences are said to have a stimulating effect. Thompson, in *Practical Dietetics*, speaking of the extract of mutton, says: "The extract has the advantage of keeping for years without decomposition, and it has been found that sometimes in cases of shock, especially after wounds received on the battlefield, its stimulant action has been considered almost equal to that of alcohol, and, bulk for bulk, it is certainly greater."

Strychnin is the alkaloid of nux vomica. It acts as a stimulant to the heart, respiratory, nervous, and muscular systems, and increases the tone of the blood-vessels. In small doses it acts as a general tonic. It accumulates in the system and may cause unpleasant effects after the repetition of even small doses. The cumulative action is especially to be feared when taken in pill form. Symptoms of muscular twitching, stiffness of the jaw with general restlessness, and jerking of the limbs are among the symptoms of overdosing.

Dose of strychnin sulphate (*strychninæ sulphas*), gr. $\frac{1}{60}$ to $\frac{1}{20}$.

Dose of tincture of nux vomica (*nucis vomicæ*), 4 to 20 minims.

Dose of fluidextract of nux vomica, $\frac{1}{2}$ to 2 minims.

Dose of extract of nux vomica, $\frac{1}{4}$ to $\frac{1}{2}$ grain.

Nitroglycerin (*glonoin*) resembles amyl nitrate in its effects. It acts less rapidly, but the effects last longer. It dilates the blood-vessels and lowers the blood-pressure. Usually its effects pass off in less than one hour. In large doses the respiration and body temperature are lowered. The face is flushed, the pulse quickened, and there is more or less headache and vertigo. It is usually given when

the arterial tension is above normal. The tablet form is most frequently used. A 1 per cent. alcoholic solution is also made. Dose, gr. $\frac{1}{200}$ to $\frac{1}{50}$.

Adrenalin chlorid acts by raising the blood-pressure, and is one of the most powerful hemostatics and astringents known. It is used mainly for hypodermic medication, usually in a 1: 1000 solution. The dose of the solution varies from 5 to 30 minims.

Strophanthus acts by contracting muscular tissue. On the heart it stimulates the contractions, decreases the rate of heart-beats, and raises the blood-pressure. It resembles digitalis in action, but does not accumulate in the system.

Dose of tincture of strophanthus (*Tinctura strophanthi*), 5 to 20 minims.

Strophanthin (tablet) for hypodermic use, gr. $\frac{1}{200}$ to $\frac{1}{60}$.

Spartein sulphate acts rapidly, increases the force and rapidity of the pulse, raises the arterial tension, and depresses the nervous system. Dose, gr. $\frac{1}{20}$ to 1.

Digitalis stimulates the heart, regulates its rhythm, slows the pulse, and increases its force; has also a diuretic action and accumulates in the system. Signs of overdosing: a slow, full pulse (it may fall to 40 beats a minute); vomiting; pain in the head; disturbed vision.

Ammonia is a diffusable stimulant, having a rapid fleeting action on the heart and respiration. Carbonate of ammonia is an ingredient of many kinds of smelling salts, and is given by cautious inhalation in fainting.

Aromatic spirits of ammonia contains, besides ammonia, oils of lemon, lavender, and nutmeg, alcohol, and water. It is used internally in doses of from ½ to 1 dram, diluted with water. ·It acts as a general stimulant.

Caffein citrat (*caffeina citras*) is contained in coffee. It quickens the heart action, raises the blood-pressure, and stimulates the brain. It also increases the respiration and has a diuretic action. Dose, gr. ½ to 2.

Alcohol in small doses increases the action of the heart, dilates the blood-vessels of the skin, increases perspiration, and at first stimulates the brain. In larger doses the cerebral excitement becomes disorderly, and there is lack of coördination of muscular movement with incoherent, rambling ideas from overstimulation of the brain-cells. In excessive doses the brain suspends its functions and there is complete unconsciousness. The whole system is intoxicated or poisoned.

Alcohol is said to diminish the waste of tissue in acute diseases where there is fever. It is not a food, as many people seem to believe, that is, it does not repair the waste of the tissues. It is said to be consumed by the oxygen contained in the tissues during fever, and in that way lessens waste, but there is grave danger of giving too much under these conditions. It is said by experienced physicians that many patients in a delirious or semi-delirious condition are made worse by too much alcohol, and nurses should exercise particular care to give only the amount ordered. Very frequently the patient's friends regard it as a sheet-anchor or a kind of "cure-all," and believe that if a little is good for the patient, more will be better. Alcohol is a drug which in improper quantities becomes a poison. That fact should never be forgotten. Unless in case of dire emergency it should never be given by a nurse without a physician's orders. The general rule observed by physicians is to order it to be given in small doses. As the effects pass off comparatively quickly and there always follows a reaction, when all the vital powers are depressed, it must be repeated frequently in cases of continued illness where it seems to be demanded. Whisky and brandy are given in water, about two parts of water to one of the drug.

Effects of Alcohol.—Herbert E. Cuff [1] gives the following signs by which a nurse may know whether it is doing good or having the reverse effect upon the patient:

"Broadly speaking, it is doing good if it tends to bring the patient nearer to his normal condition. Thus:

[1] "Lectures on Medicine to Nurses."

"1. If it slows and strengthens the too quick pulse or quickens the abnormally slow pulse. 2. If it slows the hurried respiration. 3. If it moistens the dry tongue. 4. If it cools and moistens the hot, dry skin. 5. If it lessens delirium and induces sleep, it is doing good and may be continued.

"If it has the contrary effect, and seems to add to instead of diminishing the above five conditions, it is harmful."

Preparations of Alcohol.—Alcohol is obtained by the distillation of fermented saccharine fluids, and is contained in all liquors, also in tinctures, spirits, and some liniments.

Diluted alcohol is composed of about 41 per cent. of absolute alcohol (by weight) and about 59 per cent. of water.

Whisky is obtained by distilling fermented grain—rye, wheat, or corn. It usually contains 44 to 50 per cent. of alcohol.

Brandy is a product of the fermented juice of the grape four years old. Coloring substances are used to color the darker preparations. It is often prepared by artificial means, various chemical combinations being used. It contains 39 to 47 per cent. of alcohol.

White wine is made by fermenting the juice of the grape, free from skins, seeds, and stems. It should contain 10 to 14 per cent. of alcohol.

Red wine has the same alcoholic strength. It is colored by using darker grapes and their skins.

Port wine has alcohol added during process of manufacture. It contains 30 to 40 per cent. of alcohol.

Sherry wine contains 20 to 35 per cent. of alcohol.

Champagne contains 8 to 10 per cent. of alcohol.

Claret contains tannic acid and coloring-matter and should have 5 to 7 per cent. of alcohol.

Beer, *ale*, and *porter* are made from malted grain, with hops and other bitters added. Their alcoholic strength varies from 2 to 6 per cent.

PHYSIOLOGIC EFFECTS OF FOOD AND ALCOHOL[1]

In discussing the physiologic effect of alcohol, Dr. Hall makes use of what he regards as the "deadly parallel" between food and alcohol:

FOOD	ALCOHOL
"1. A certain quantity will produce a certain effect at first, and the same quantity will always produce the same effect in the healthy body.	"1. A certain quantity will produce a certain effect at first, but it requires more and more to produce the same effect when the drug is used habitually.
"2. The habitual use of food never induces an uncontrollable desire for it in ever-increasing amounts.	"2. When used habitually it is likely to induce an uncontrollable desire for more, in ever-increasing amounts.
"3. After its habitual use, a sudden total abstinence never causes any derangement of the central nervous system.	"3. After its habitual use, a sudden total abstinence is likely to cause a serious derangement of the central nervous system.
"4. Foods are oxidized slowly in the body.	"4. Alcohol is oxidized rapidly in the body.
"5. Foods, being useful, are stored in the body.	"4. Alcohol, not being useful, is not stored in the body.
"6. Foods are the products of constructive activity of protoplasm in the presence of abundant oxygen.	"6. Alcohol is a product of decomposition of food in the presence of a scarcity of oxygen.
"7. Foods (except meats) are formed in nature for nourishment of living organisms, and are, therefore, inherently wholesome.	"7. Alcohol is formed in nature only as an excretion. It is, therefore, in common with all excretions, inherently poisonous.
"8. The regular ingestion of food is beneficial to the healthy body, but may be deleterious to the sick.	"8. The regular ingestion of alcohol is deleterious to the healthy body, but may be beneficial to the sick (through its drug action).
"9. The use of food is followed by no reaction.	"9. The use of alcohol, in common with narcotics in general, is followed by a reaction.
"10. The use of food is followed by an increased activity of the muscle-cells and brain-cells.	"10. The use of alcohol is followed by a decrease in the activity of the muscle-cells and brain-cells.
"11. The use of food is followed by an increase in the excretion of CO_2.	"11. The use of alcohol is followed by a decrease in the excretion of CO_2.
"12. The use of food may be followed by accumulation of fat, notwithstanding increased activity.	"12. The use of alcohol is usually followed by an accumulation of fat through decreased activity.
"13. The use of food is followed by a rise in body temperature.	"13. The use of alcohol may be followed by a fall in body temperature.
"14. The use of food strengthens and steadies the muscles.	"14. The use of alcohol weakens and unsteadies the muscles.
"15. The use of food makes the brain more active and accurate.	"15. The use of alcohol makes the brain less active and accurate."

CARDIAC SEDATIVES

A great many drugs, especially those used as nerve sedatives and antipyretics, exercise a depressing action on the heart, rendering great caution necessary in their

[1] From "Text-book of Hygiene," by George H. Rohe, M. D., and Albert Robin, M. D.

use. When it becomes necessary to depress the heart and general circulation, aconite and veratrum viride are frequently used for that purpose.

Aconite (*aconitum*) acts as a powerful depressant to the heart, respiration, and, to some extent, to the nervous system. It is also antipyretic, diaphoretic, and diuretic. The tincture is the preparation most frequently used. Dose of the tincture, 1 to 4 minims; of the fluidextract, 1 to 2 minims. Signs of overdosing are tingling sensation, weak, irregular, slow pulse, shallow respiration.

Veratrum viride is occasionally given in cases of convulsions, acute mania, aneurism, and cerebral inflammation. It reduces the force of the pulse, but at first does not affect its rapidity. If continued, the pulse becomes very slow and compressible, the least exertion markedly quickening it. In large doses there is decided muscular weakness and nausea, the skin becomes cold and clammy, there is also hiccough, dizziness, or partial unconsciousness. Death may result from paralysis of the heart. The patient should be kept absolutely lying down. If the pulse falls much below 60 while giving veratrum it should be considered a danger signal. It is usually given in tincture form, 1 drop being given and repeated at intervals till the desired effect is produced. Maximum dose of the tincture, 20 minims; of the fluidextract, 3 minims.

CHAPTER XXXIV

REMEDIES WHICH IMPROVE DIGESTION AND NUTRITION

The **nutrition of the body** is dependent on good digestion and good assimilation of the food that is provided. Drugs are useful in certain conditions, but the tendency of the laity is to depend altogether too much on drugs to improve digestion. If debilitated or diseased tissue is to be replaced by normal healthy tissue in the body, if strength and energy are to be restored, the patient must desire natural food and take and assimilate it in sufficient quantity, since food, and food only, can furnish to the blood the substances which the cells of the body need for building up and restoring normal conditions. Hence, it is of first importance that the food be wisely chosen and properly prepared.

Tonics are defined as agents which improve the general health of the body. The term would include a large group of drugs, including many stimulants already mentioned. The most typical tonics are strychnin, quinin, iron, and the vegetable bitters. Iron, manganese, cod-liver oil, and other fats are given to increase the red corpuscles of the blood.

Natural tonics would include fresh air, moderate exercise, sunshine, pleasant associations and surroundings, dainty serving of food, and attractive cookery. A brisk walk in the open air, especially cold air, acts as a natural stimulant to the appetite.

Sunshine is as essential to the health of human beings as to plants. It may not be possible to explain the mysterious process by which the sun affects the general condition of the system, but it is well known that it does so.

Mental Influence.—The mind influences the body in a subtle, mysterious way, and pleasant association and wholesome mental influence are in themselves efficient tonics.

Attractive cookery and serving of food are powerful factors in creating both an appetite for food and in preparing the digestive organs to deal with it. It has been proved by physiologic experiment[1] that "there are two tides of gastric juice secretion. The first, 'appetite juice,' is induced by hunger and the pleasurable sight or smell of food, or the sounds associated with its preparation, and is psychic. This secretion is abundant and actively digestant. The second is excited by the mechanical and chemical action of food in the stomach. Of the two, the former often proves the more important, for food which is unappetizing or food which for any reason is eaten without relish, or while the mind is strained in the other channels, may remain for hours undigested."

"**Appetite may be depressed** or destroyed by mental emotion, especially grief, anxiety, and worry; by the sight, smell, or taste of ill-prepared or improperly cooked or badly served food; foul air and poor hygienic surroundings; diseases and most gastric disorders; nausea; the abuse of strong condiments, and of many drugs, notably opium, and those which, like potassium iodid, produce a continual offensive taste in the mouth; the abuse of alcohol; eating irregularly and at too short intervals."

It does not require an intricate physiologic experiment to teach a nurse that artistic cookery and food serving stimulate the digestive juices. She has probably experienced the sensation of having her "mouth water" at the sight of some tempting food or when a pleasant odor of cookery was wafted to her. In other words, the nerves of sight and smell stimulated the salivary glands, so that there was a greater flow of saliva ready to act on the food as soon as it entered the mouth. The nerves of sight, smell, and taste exert a similar action on the nerves of the stomach, causing a greater flow of gastric juice.

Mental Emotion.—A well-known medical writer has stated that the expression "laugh and grow fat" is certainly not without a physiologic basis. It is well known

[1] *Practical Dietetics*, Thompson.

that pleasurable emotions aid digestion, and that fright, terror, or excessive nervous excitement hinder it; also that if anxiety or worry be prolonged, digestion is invariably impaired, even though the appetite may remain apparently normal.

Pepsin (*pepsinum*) is the most widely used of all the artificial digestive preparations. It is obtained from the inner coat of the stomach of the pig. It has the power of converting albuminoids (casein, albumin, etc.) into peptones, with the aid of hydrochloric and lactic acids. It always requires an acid reaction to do its work, and should never be given in combination with soda bicarbonate or any alkali, unless so ordered. Occasionally, when too much hydrochloric acid and too little pepsin is the digestive difficulty, soda bicarbonate may be given to neutralize the excess of the acid. It is believed by many authorities that pepsin is of much less importance in gastric disorders than hydrochloric acid, and that except in cases of hyperacidity of the stomach they should be used together.

Hydrochloric acid (*acidum hydrochloricum*) is formed by combining common salt with sulphuric acid. It is always given diluted. The dose of the diluted hydrochloric acid is from 5 to 10 drops.

Pancreatin (*pancreatinum*) is a digestive ferment usually obtained from the fresh pancreas of the pig or calf. It digests albuminoids and emulsifies fats, and is said to be more serviceable for the predigestion of food than any of the other ferments. It is usually given with soda bicarbonate, as it requires an alkaline solution to do its work. It is said that most of the so-called "peptonized foods" are made with pancreatin instead of pepsin. It is used both in powder form and in solution. Groff gives the following formula for preparing a fresh solution: "It may be prepared by soaking the cleaned and chopped fresh pancreas of the pig in diluted alcohol for twenty-four hours; pouring off the alcohol; adding ten times its weight of glycerin, and, after twenty-four hours of stand-

ing, pouring off and straining the liquid. This may be used in the place of the commercial powder and is always effectual, while the latter, through ignorance in making or carelessness in keeping, may be quite worthless." When glycerin is combined it should not be used for preparing foods for nutrient enemata.

All peptonized or pancreatinized foods are said by Thompson to be open to the objection that they are much more expensive, if used for long at a time, than the preparations which can be easily made at the bedside by any intelligent person by the use of simple pancreatin extracts.

Diastase is a vegetable ferment that converts starch into grape-sugar or glucose.

Taka-diastase is a powerful starch digestant used in small doses in certain forms of dyspepsia.

Rennet (*rennin*) is obtained from the stomach of the calf. It has special milk-curdling properties and is the chief ingredient of the so-called junket tablets.

Caroid is another vegetable ferment useful in softening meat fibers. It coagulates milk similar to rennet and dissolves gastric mucus. It is similar in action to papoid or papain, both being obtained from the pawpaw tree in South America.

Constitutional Tonics.—Iron (*ferrum*), in all its numerous forms and preparations, is obtained from the metal. It is found in the blood and is contained in various foods, notably beef. In small doses it increases the appetite and improves digestion. In large doses or long-continued small doses it is liable to produce nausea, indigestion, and constipation. It has an astringent action and darkens the stools, has also an irritant effect, and acts injuriously on the teeth.

Tincture of chlorid of iron (*tinctura ferri chloridi*) is said to be one of the best preparations for internal use. In giving all preparations of iron, constipation must be guarded against by some form of laxative.

Cod-liver oil (*oleum morrhuæ*) is obtained from the

liver of the common codfish. It contains iodin, phosphorus, and other important mineral ingredients. In the body it produces heat and energy; is exceedingly nauseous to the taste, though there are preparations from which the disagreeable taste and odor have been largely removed. These are usually less valuable in medicinal qualities than the common oils. The directions given for taking castor oil may be used to disguise the disagreeable taste.

Vegetable Bitters.—Gentian (*gentiana*) is a simple bitter tonic that has held its place as a valuable medicine from early historic times.

Cinchona bark preparations are similar in action to gentian as a bitter tonic.

Quinin (*quininæ sulphas*) is one of the four alkaloids of cinchona. In small doses it acts as a bitter tonic and slightly stimulates respiration. In larger doses it has a depressing effect on the heart and circulation, causes ringing in the ears, dizziness, and headache. It acts as an antipyretic in malarial fever, and is used both for preventive and curative effect.

CHAPTER XXXV

NERVE SEDATIVES AND ANTIPYRETICS

Sedatives are defined as remedies which diminish the activity of the tissues of the body. Nerve sedatives act particularly on the brain and nervous system. Many drugs produce sleep, but do not relieve pain.

Some of the drugs which relieve pain also reduce fever. All of these drugs act more or less disastrously on the tissues of the body. The immediate bad effects from their use may not be readily apparent, but it should always be remembered that while such drugs may be necessary under certain conditions, they do produce injurious effects on some of the tissues and should never be used unnecessarily. They

are emergency remedies, useful to tide over a certain point in disease, but to be discontinued as soon as the emergency is passed. Because the nurse is so often left to decide whether or not a sleep-producing drug is really necessary, special study should be given to this group of drugs and their effects, and also to the simple substitutes, which sometimes can be used instead of drugs of this class.

Outdoor Air.—One of the facts which has received abundant demonstration is that the atmosphere has both tonic and sedative properties. A condition of delicious drowsiness and disposition to sleep a great deal more than usual is one of the common experiences of invalids who have adopted tent life for a time. Therefore, among the very first sedatives should be placed plenty of fresh air. One great reason for sleeplessness in many cases is that the room is too warm, leaving out of the question the frequent impurity of the air. In steam-heated houses and apartments this is a very common condition unless the heat and ventilation are carefully regulated.

Water.—The sedative effects of cold, tepid, or neutral baths or packs are recognized by all medical authorities. It has happened not infrequently that a nervous patient who has resisted the influence of moderate doses of powerful drugs used to induce sleep, has quickly fallen asleep after the application of a tepid pack or bath. In quieting the delirium of fever and the excitability of certain classes of insane patients, the effectiveness of this form of treatment are every day being demonstrated.

Warmth.—Cold air for the lungs is conducive to sleep, but the patient should be warmly clad, so that no part of the body becomes chilled, if sleep is desired. Cold feet and general chilliness are quite sufficient to produce wakefulness without any other cause. It is better to have the feet thoroughly warm and the bed warm before sleep is desired, than to depend on applying artificial heat to the feet at the time. The mere presence in the bed of a hot-water bottle, 10 or 12 degrees above body heat, is sufficient to keep a sensitive, nervous patient awake.

Removal of Physical Discomfort.—This would include straightening out wrinkles in the sheets or clothing, brushing out crumbs, shaking and turning pillows, bathing face and hands, etc., all of which should be done and the patient made as comfortable as possible before turning out the lights.

Darkness is quite as necessary for human beings as for plants, and Nature's plan is to have darkness as the time for rest. Few individuals can expect to sleep soundly and restfully unless quietness and darkness are produced. Noise and light are directly antagonistic to sleep.

Mental excitement, as far as possible, should be guarded against for three or four hours before bedtime in the case of wakeful invalids. This would possibly require the prohibition of reading, animated discussion of any subject, visitors, concentrated thought, or anything that might tend to cerebral excitement or activity. It is certainly foolish to cause the brain to be excited or stimulated by these means, and then depend on drugs to counteract the excitement.

Food.—As a general rule, it is a mistake to give a full meal just before bedtime, but it is also a mistake to expect a patient to go to sleep promptly with the stomach entirely empty. A cup of thin gruel or hot milk sipped slowly, with a few crackers, at bedtime act as a hypnotic with a great many patients, and these measures leave no injurious effects. Tea or coffee should not be used for the evening meal when there is a tendency to sleeplessness.

Rubbing also tends to quiet the nerves, and may be employed to good advantage. In many cases gentle rubbing up and down the spine may wisely be given for some time after the body has been rubbed.

Reading aloud some story or selection that has no special plot and that is not of special interest to the patient, has also proved useful in chronic nervous patients afflicted with insomnia. Poetry is especially recommended for this kind of reading. No special elocutionary powers are

necessary or desirable. Monotonous reading is much more likely to produce the desired effect.

Chloral hydrate (*chloralum hydratum*) and other chloral preparations act as hypnotics, producing sleep, but not relieving pain except in dangerous doses. Chloral depresses the nerve centers and heart muscles and lowers arterial tension. Occasionally chloral produces very undesirable effects, such as headache. On the brain it produces a stupor resembling natural sleep. Prolonged use leads to habit, and the chloral habit soon acts disastrously on the whole constitution, producing a condition of marked anemia and muscular weakness. It is said that many cases of insanity have their origin in the chloral habit. Potter gives gr. xv as an average dose for a healthy adult; for a child, gr. j for each year of age up to gr. vj. It is given dissolved in water or syrup.

Hyoscine hydrobromate (*hyoscinæ hydrobromas*) acts on the spinal cord and brain, and in large doses acts as a powerful respiratory depressant. Prolonged use deranges the mental faculties. Both it and chloral are used as hypnotics in cases of acute mania, delirium tremens, and other cases of intense mental excitement. Dose, gr. $\frac{1}{100}$ to $\frac{1}{50}$.

Sulphonal was at first believed to produce sound restful sleep without any injurious effects. A prominent medical authority has stated after some years of experience and observation that "if it were not for the very evident advantage of sulphonal, when used with care and under medical supervision, it would probably either be excluded from practice or its sale restricted by legislative authority." It acts directly on the brain cells and red blood-corpuscles. Prolonged use causes ringing in the ears, dizziness, weakness, and inability for mental or physical effort. It has a marked destructive action on the red blood-corpuscles. It is usually given in hot milk or other hot fluid about two hours before it is desired to produce sleep. Dose, gr. x to xxx.

Trional is very similar in its composition to sulphonal.

It is said to be specially valuable in obstinate insomnia and in many forms of delirium. When pain is present it is sometimes combined with acetanilid or phenacetin. Dose, gr. x to xxx.

Paraldehyd is similar in its action to chloral, but safer. Its effects pass off more quickly than chloral and it often needs to be repeated. It has a diuretic effect, slows the heart, and strengthens it. Prolonged use leads to habit, which soon wrecks the constitution. A toxic dose paralyzes the centers controlling respiration. Potter quotes the average dose for an adult as ʒiss. It is given in water or some aromatic fluid.

Bromids.—In this group are included potassium bromid, sodium bromid, ammonium bromid, and several other preparations of the drug less frequently used. They reduce blood-pressure, slow respiration, and slow and weaken the heart. Bromids are preëminently depressants of the brain and heart. They are said by eminent authorities to be direct nerve poisons. Sodium bromid is said to be the least poisonous and the most hypnotic; potassium bromid, the most poisonous to the heart and muscular system and the least hypnotic. Sodium bromid has been used to special advantage in cases of epilepsy, and all bromids are useful in convulsive and spasmodic affections. When their use is prolonged, cathartics are needed occasionally to prevent accumulation in the system, and arsenic is given to combat the acne. They should not be given in conditions where anemia exists, and patients using the drug should be under the daily supervision of a physician. Prolonged use deranges the mental faculties. The dose of potassium or sodium bromid is quoted as gr. x to xx. Both may be given dissolved in water.

Opium relieves pain, produces sleep, and has a diaphoretic action. It checks all the secretions of the body except those of the skin and mammary glands, contracts the pupils, first stimulates and afterward depresses the brain, heart, and organs of respiration. It is said to cause unconsciousness by intoxication. Frequent use

leads to habit, which soon wrecks the entire physical, mental, and moral faculties.

Opium contains seventeen alkaloids, of which morphin and codein are used most frequently. All forms of opium in time lead to habit.

Morphin sulphate (*morphinæ sulphas*) is used extensively, administered by hypodermic, for the relief of pain, either alone or in combination with atropin. By combination of the two, the nausea, depression, constipation, and other bad after-effects of morphin are lessened or avoided. Atropin acts also as a cardiac and respiratory stimulant, and thus counteracts the depression produced by morphin in specially susceptible subjects. A moderate dose of morphin for an adult is from gr. $\frac{1}{8}$ to $\frac{1}{4}$. Atropin is combined in the proportion of gr. $\frac{1}{120}$ to $\frac{1}{100}$ to gr. $\frac{1}{4}$ of morphin.

Codein (*codeina*) is less powerful in its pain-relieving effects than morphin, less constipating, and less liable to create a habit. Dose, gr. $\frac{1}{2}$ to j.

Laudanum (*tinctura opii*) is given internally, either by mouth or rectum, and is used externally in lotions and liniments, chiefly for the relief of pain and for its astringent effects. It contains about 44 grains of opium to the ounce; 60 minims yield, on the average, 120 drops. The dose is quoted at ♏v to xxx. Regarding fatal doses, Potter states that in a child one day old 1 minim of laudanum caused death, and that a medicinal dose given to a nursing mother proved fatal to the infant.

Heroin is another preparation of opium, used frequently in bronchitis and other respiratory affections. Adult dose, gr. $\frac{1}{20}$ to $\frac{1}{10}$.

Paregoric (*tinctura opii camphorata*) has about one-twentieth the strength of laudanum; 1 ounce contains nearly 2 grains of opium. It contains camphor and other ingredients. The dose for an adult is quoted at ʒj to iv. The dose for infants needs to be carefully graded according to the age. For children under two years the dose ranges from ♏j to xv. Many fatalities have attended

the promiscuous use of laudanum and paregoric. Children do not bear any of the opium preparations well.

Signs of opium-poisoning are heavy sleep, from which the patient cannot be aroused, diminished respiration, contracted pupils, slow, full pulse. Atropin, caffein, and permanganate of potassium are antagonists to opium. Caffein is frequently given in the form of strong coffee. Permanganate of potassium is given dissolved in water, about gr. iij to v being an average dose. If the drug has been taken by mouth, the stomach should be promptly emptied by emetic. The bladder should be emptied, and the patient kept from relapsing into drowsiness and unconsciousness, if possible. A nurse would seldom if ever be justified in giving atropin without a physician's order. Strychnin and heat are used if needed, and artificial respiration is often continued for hours.

Salol, sodium salicylate, and **salicylic acid** are all produced from salicinum, a neutral principle obtained from species of willow and poplar trees. These drugs are used in acute rheumatism to reduce joint swellings, lower temperature, and relieve pain. All are diaphoretics.

Salol is much used as an intestinal antiseptic. It is said to promote the healing of the ulcers in typhoid fever and to hinder reinfection. It causes profuse sweating, reduces temperature, relieves pain, and is occasionally followed by depression. It is considered non-poisonous. The dose ranges from gr. v to xx.

Acetanilid (*acetanilidum*) or **antifebrin** relieves pain, produces sleep, and reduces temperature. It is a powerful diaphoretic, a cerebral sedative, and depresses the heart. Many fatalities have attended its use. It is used in nearly all the patent headache powders. Dose for an adult, gr. ij to x. More than gr. xxx in twenty-four hours are rarely if ever given. Antikamnia is a proprietary remedy said to contain acetanilid and soda bicarbonate.

Phenacetin (*phenacetinum*) resembles acetanilid in action, but reduces fever more gradually, and is less liable

to cause collapse. It relieves pain and induces sleep. Dose, gr. ij to xx.

Guaiacol, a substance obtained from beechwood tar, is used chiefly to reduce temperature and as an expectorant. Dose, ♏v to xxx. Carbonate of guaiacol, gr. j to v. Guaiacol is sometimes given by simply applying it to the skin. It is used also as an intestinal antiseptic.

Chloretone is obtained from chloroform. It produces sleep, is said to be non-poisonous, and without effect on the heart. Dose, gr. v to xx.

Anesthetics are drugs which produce a condition of insensibility. They may be classified as local and general, the former acting only on the part to which they are applied, the latter affecting the whole system. They are given to relieve the pain of surgical work; to lessen the suffering of childbirth; to overcome convulsions or general spasms from any cause; to produce muscular relaxation in fractures and dislocations, and to aid in certain examinations of the body.

Ether, chloroform, and nitrous oxid are the agents chiefly used for general anesthesia.

Chloroform (*chloroformum*) is preferred in brain and eye work, and when lung or kidney disease is present.

Ether is not so powerful as chloroform, slower in producing effects, but safer. Ether is a cardiac stimulant, but is contra-indicated in diseases of the respiratory organs.

Ether is inflammable, while chloroform is not.

Nitrous oxid (*laughing gas*) is frequently used as a preliminary to other general anesthetics, or to regain motion in ankylosed joints.

Cocain hydrochlorate (*cocainæ hydrochloridum*) is the most widely used of all local anesthetics. It may be dropped from a medicine-dropper, used in the form of a spray, applied on cotton, or given hypodermically. Cocain solutions rapidly deteriorate in quality, and should be made as needed, the tablet being dissolved in a saturated solution of boracic acid.

Sulphuric ether and *ethyl chlorid* are used as a spray.

Where no other local anesthetics are to be had, a mixture of ice and common salt, applied in a gauze bag for a sufficient length of time, will freeze the part, and an incision can be made without great pain.

CHAPTER XXXVI

ANTISEPTICS AND DISINFECTANTS

Antiseptics are substances which prevent decomposition and decay. They retard the growth of bacteria, but do not destroy them.

Germicides and **disinfectants** are substances which destroy germs.

Sterilization.—"An object is said to be sterilized when all the forms of life contained within it or on its surface are destroyed. All processes which sterilize are necessarily also disinfectants, but all disinfecting processes by no means cause sterilization. This distinction between disinfection and sterilization arises principally from the fact that some of the microörganisms have spores which correspond to the seeds of plants, in being very much more resistant to all the influences which destroy the parent cells" (Rosenau).

Ice is an antiseptic in its action, as no germ can multiply without a certain degree of warmth.

Salt and **sugar** are both antiseptic in their action on meat or vegetable matter. They preserve from decomposition, but do not destroy infectious germs. Normal salt solution is one of the much-used antiseptic solutions. It is used for irrigation of wounds, for douches of various kinds, and as a stimulant in case of collapse, hemorrhage, septicemia, and coma. In its composition it closely resembles blood-serum. It is made by dissolving 1 dram of common salt (sodium chlorid) in 1 pint of water.

Boracic or **boric acid** (*acidum boricum*) is produced from borax by combining with sulphuric acid. It is much used in surgical work for its antiseptic and unirritating qualities. A solution of 1 : 133 checks the growth of bacteria. It is generally used as a saturated solution. Boric lint or gauze is made by soaking the gauze in a boiling saturated solution and drying. It is said to contain nearly one-half its weight of the acid.

Borax (*sodium borate*) is much used externally as a lotion. It is antiseptic and disinfectant, having the power to destroy many forms of bacteria.

Peroxid of hydrogen (*hydrogenii dioxidum*) or **oxygenated water** is classed as a non-toxic antiseptic. When applied to suppurating wounds it produces a foam—the result of its chemical action on pus. It is said that 1 part added to 1000 of water containing infectious germs is sufficient to destroy the organisms in twenty-four hours. It is much used as a gargle or spray to the throat and nasal passages.

Carbolic acid (*phenol*) has extensive and varied use as a disinfectant. It cannot be depended on to kill spores, and should not be used as a disinfectant in case of tetanus, malignant edema, or other diseases due to spore-bearing bacteria. Rosenau, quoting Behring, states that the germs of cholera, typhoid fever, diphtheria, and erysipelas are killed in one minute by a solution of 1½ per cent. of carbolic acid. It is generally used in a solution of from 3 to 5 per cent. for disinfectant purposes, and clothing or material requiring deep penetration should be left in the solution one hour. It is considered a more reliable disinfectant for soiled clothing, urine, and excreta than bichlorid of mercury, as it does not coagulate albuminous matter. It is not destructive to metals, fabrics, or colors, nor to wood. It should be dissolved in hot water and well shaken. Extensive burns have been caused by neglect to have the acid thoroughly dissolved. It is a corrosive poison which is readily absorbed and rapidly diffused through the system. Severe constitutional results have been produced

by one vaginal douche of a moderately strong solution. A peculiar smoky or olive green color to the urine is one of the first signs of carbolic acid poisoning. This has occurred sometimes by absorption from dressings. It is one of the most rapidly acting poisons known. Alcohol neutralizes its effects. Cider vinegar is also an antidote.

Creolin contains carbolic acid and other ingredients held in solution by soap. It is said to be equal to carbolic acid in disinfectant properties, but its field of usefulness is more limited, owing to the dark stains it produces.

Lysol forms a soapy, frothy liquid when added to water. It is more powerful as a germicide than carbolic acid, and has an irritant and caustic action on the skin and mucous membrane. One authority who recommended its use in obstetric and gynecologic work states that a solution of 1:200 destroys streptococci in fifteen minutes. It is used considerably as a disinfectant for the skin and in vaginal douches, but is rarely used for a disinfectant for utensils, owing to its cost. It is rarely used on the skin in a solution stronger than 2 per cent. and a solution of ½ of 1 per cent. has caused severe irritation on a sensitive skin.

Bichlorid of mercury is one of the most valuable and powerful disinfectants. It kills both germs and their spores. It corrodes metal and coagulates albuminous matter, making penetration impossible. It should, therefore, not be used for the disinfection of sputum, feces, urine, or clothing soiled with these substances. It should not be used for disinfecting water-closets or plumbing, as in time it renders lead pipes brittle and worthless. It is more powerful as a germicide if used hot. On the flesh it acts as a corrosive poison, and has produced painful burns when applied to the vaginal mucous membrane in a too strong solution.

Rosenau[1] gives the following facts regarding its potency: "A solution of 1:1000 is ample for the destruction of all the non-spore-bearing bacteria at the ordinary temperatures, provided the exposure is continued not less than

[1] *Disinfection and Disinfectants.*

one-half hour. Many bacterial cells are killed at once when brought in direct contact with a solution of this strength, and the great majority are destroyed in fifteen minutes; but the extra time, as given, allows for penetration, which is usually required in actual practice. Solutions of bichlorid of mercury of the strength of 1: 800 and 1: 500 are very strong germicides and will kill non-spore-bearing infections in a short time. For spores a solution of 1: 500 is necessary and an exposure of one hour. Articles may be disinfected by immersing them in a solution of 1: 2000, provided that the exposure is not less than two hours. A strength of 1 : 15,000 is sufficient to prevent putrefaction and fermentation."

Formalin consists of a 40 per cent. solution of formaldehyd dissolved in water. A 4 per cent. solution of formalin is about equivalent to a solution of bichlorid of mercury of 1 : 1000, and superior in germicidal properties to carbolic acid in a 5 per cent. solution. It is not much used as a disinfectant for the sick room except as a gas, but large quantities of roots, bulbs, fruit, and similar articles are disinfected by it in quarantine stations. It is used in agriculture to destroy parasitic growths on vegetables and fruit. It is believed to be non-poisonous and is sometimes added to milk and other liquid foods as a preservative. It is said that a very small amount, 1 : 25,000 or less, is sufficient to arrest the development of bacteria in these substances.

Formaldehyd gas is the substance usually depended on for disinfection of rooms. No gaseous disinfectant can be depended on to disinfect beneath the surface, and it is considered best to obtain a large volume of gas in a short time. For this reason, lamps and many slow-acting generators are considered an unreliable method of using it. It has no injurious effect upon fabrics or colors. It should never be used in a room in which the temperature is below 50° F. A higher degree of heat aids the disinfecting power of the gas. A certain amount of moisture in the air is also needed for efficient disinfection, and a bucket of boiling

water should be set in the room previous to liberating the gas. It has the power of killing spores, but as these are often incorporated in albuminous matter or dust, long exposure is necessary, and it does not penetrate below the surface of mattresses, quilts, or any article. It is not an insecticide and has practically no effect on bed-bugs, roaches, and such vermin.

Liquid ammonia sprinkled about the room is said to be useful in neutralizing the fumes after disinfection is completed.

The germicidal properties of formaldehyd gas are increased by combining it with permanganate of potassium. One pint of formaldehyd for each 1000 cubic feet of air space is considered sufficient. To this is added 3½ ounces of permanganate of potassium. The potassium crystals are put into a tin vessel or pail, which is set inside a wooden or pulp bucket, and the formaldehyd poured over them, after the room has been properly sealed. This method is considered by many authorities more reliable than the sheet method, in which the formaldehyd is sprayed on a sheet which is hung over a line. When combined with the potassium permanganate it has proved more uniformly effective, and less likely to be hindered in action by change of temperature or the degree of moisture. A sixteen-hour exposure is considered sufficient. It is stated that much of the formaldehyd sold in the United States cannot be relied on, and that to be effective it must be of not less than 38 per cent. in strength.

Tablets or powders containing the required amount of permanganate of potassium to combine with formaldehyd for disinfection are obtainable in modern drug stores.

Sulphur gas is comparatively seldom used, but is an efficient surface disinfectant. It does not kill spores. It also requires moisture. It injures metal and cotton and linen fabrics. Authorities on disinfection state that 5 pounds burned in 1000 cubic feet of space will kill non-spore-bearing germs after sixteen hours' exposure. It has the advantage of cheapness and can usually be readily obtained. In arranging it, it is considered best to place

it in several vessels rather than all in one, especially if a large room is to be disinfected. The gas is generated by saturating the sulphur with alcohol and igniting. Care should be used to avoid fires.

Milk of lime is one of the least expensive of all disinfectants. It can be used to disinfect excreta in the sick room or in sinks, drains or stagnant pools, or to whitewash exposed surfaces. Lime which has been exposed to the air soon becomes inert. Solutions should be freshly made at least every two days.

The hydrate of lime is made by adding 1 pint of water to 2 pounds of lime. The milk of lime contains 1 part of hydrate of lime to 8 parts of water. Air-slaked lime is worthless, but the dry hydrate may be preserved for some time in an air-tight container. The milk of lime should be added in quantity equal to the amount of excreta to be disinfected and thoroughly mixed. Two hours' exposure is necessary.

Pure dry quicklime may be freely mingled with the mass and will disinfect in less time.

Chlorid of lime is said to be one of the strongest disinfectants known, and is useful in the disinfection of excreta, sinks, water-closets, and drains. It is usually made in a 4 per cent. solution, which requires approximately 6 ounces of lime to the gallon. It should never be used to disinfect clothing of any kind, as it ruins the fabric.

Oxalic acid and **permanganate of potassium** have a somewhat limited field of application, being used principally as disinfectants of the skin and mucous membrane.

Oxalic acid is a corrosive poison, one of the most rapidly acting of all poisons, causing death in a few minutes when taken internally in poisonous doses.

Permanganate of potassium is frequently employed for irrigation when fetid discharges are present, and is also used for internal medication. When used in solution as a disinfectant, a strength frequently employed is 1 dram of the crystals to 1 pint of water.

Oxalic acid injures the metal coating of sinks and basins and will destroy linen, cotton, or similar material if ex-

posed to it for any length of time. Weak solutions of chlorid of lime and oxalic acid are sometimes used for bleaching, but the process requires much care or the article will be damaged. Oxalic acid in solution effectively removes the stains made by permanganate of potassium.

Alcohol is used as a disinfectant, particularly for fine-edged cutting instruments, sutures, and for the skin; it is also used to neutralize carbolic acid which has been used pure for disinfection. Commercial alcohol contains 91 per cent. absolute alcohol with 9 per cent. of water. Alcohol in the strength of 70 per cent. is sufficient for disinfection of these materials.

Percentage Solutions.—One fluidounce of water (480 minims) weighs 456.4 grains. One pint of water (7680 minims) weighs 7302 grains or, practically, 7300 grains. A 10 per cent. solution or 1 : 10, it will thus be readily seen, is one which contains 730 grains of some substance in 1 pint.

To prepare 1 fluidounce of a solution the following table may be convenient:

Required to contain of a substance.	Take of the substance (approximately).	
0.1 per cent.	0.46 grain (½ gr.)	And enough water to make 1 fluidounce.
0.5 "	2.28 " (2¼ ")	
1 "	4.56 " (4½ ")	
2 "	9.13 " (9 ")	
3 "	13.69 " (13½ ")	
4 "	18.26 " (18¼ ")	
5 "	22.82 " (23 ")	
6 "	27.38 " (27½ ")	
7 "	31.95 " (32 ")	
8 "	36.51 " (36½ ")	
9 "	41.08 " (41 ")	
10 "	45.64 " (45½ ")	

CHAPTER XXXVII

MISCELLANEOUS REMEDIES

The term "specific," as applied to remedies, is used in speaking of any medicine which exerts a peculiar influence over any part of the body; or one which prevents or cures

disease by a peculiar adaptation to that disease and not on general principles.

Specifics.—There are but very few drugs which exert this specific action on disease. The chief ones are mercury and iodid of potassium, which exercise a special curative action in syphilis; quinin, in malaria; and antitoxin, in diphtheria.

Mercury (*hydrargyrum*) or **quicksilver** is a shining, silver-white, fluid metal. In the system its different preparations exert various actions. Some of its salts are corrosive poisons; others act as local caustics; others as tonics, purgatives, alteratives; while others check inflammation and promote absorption. It stimulates most of the glands of the body, has a tendency to accumulate in the liver, is quickly absorbed by the blood, and remains in the tissues for an indefinite time, producing a gradual change. In small doses mercury for a time may act as a blood tonic and improve the general condition, but if long continued, waste is promoted by overstimulation of the lymphatic system and salivation. It is said that salivation is most likely to follow blue mass pills (of which mercury is an ingredient). Salivation occurs less frequently as an effect of calomel and gray powder. Individual susceptibility plays a prominent part in salivation. It occasionally occurs after one moderate dose. It is most likely to occur after mercury has been administered internally and by inunction. It is said that an acute coryza not infrequently follows a large dose of blue mass pills which has not been followed by a saline cathartic, the individual exhibiting all the signs of an acute severe influenza. Mercury is used in solution, ointment, powder, pill, tablet, and plasters.

Among the preparations of mercury are:

Calomel (*hydrargyri chloridum mite*).

Gray powder (*hydrargyrum cum creta*) or mercury with chalk.

Blue mass (*massa hydrargyri*), mass of mercury, otherwise known as blue pill, contains mercury, licorice, glycerin, and other ingredients.

Protoiodid of mercury (*hydrargyri iodidum flavum*) or yellow mercurous iodid.

Biniodid of mercury (*hydrargyri iodidum rubrum*) or red iodid of mercury.

Bichlorid of mercury (*hydrargyri chloridum corrosivum*), corrosive sublimate.

Black wash (*lotio hydrargyri nigri*), made by applying calomel gr. xviij to lime-water ℥x.

Yellow wash (*lotio hydrargyri flava*), made by adding corrosive sublimate gr. xviij to lime-water ℥x.

Symptoms of overdosing with mercury are fetid breath, swollen and spongy gums, with a bluish line along the margin, loosening and soreness of the teeth, an excessive flow of saliva and a metallic taste, ulceration of the lips and tongue.

Albumen in some form, usually the white of egg, is used as an antidote in case of accidental overdosing. It should be promptly followed by an emetic.

In giving mercurial ointment by inunction it is a safe precaution to cover the hand with a rubber glove to prevent absorption of the drug by the hand, as well as possible infection by specific poison.

Bichlorid of mercury is the most actively poisonous of all the mercurial preparations. In poisonous doses internally it acts as a powerful gastro-intestinal irritant, producing a burning pain, suppression of urine, bloody stools, collapse, and death. The application of a too strong solution to the mucous membrane produces a burning sensation; the tissues are corroded and ulcerated.

Iodin (*iodum*) acts as an irritant to the skin and mucous membrane, and in large quantity may produce blistering. Among its preparations are:

Tincture of iodin (*tinctura iodinii*).

Iodoform (*iodoformum*).

Iodid of potassium (*potassii iodidum*).

Iodid of ammonia (*ammonii iodidum*).

Iodid of sodium (*sodii iodidum*).

Aristol, *iodol*, *antiseptol*, and various other similar prep-

arations are chemical productions of iodin combined with other substances.

Iodid of potassium is the form in which iodin is most frequently used internally. It is used to counteract various pathologic conditions, to promote absorption of morbid products, and to aid in the elimination of certain poisons. It is occasionally used as an expectorant and in weak solutions as a gargle. It is given dissolved in water. A solution of iodid of potassium is frequently made in the strength of 1 dram of the powder to an equal amount of water, of which 1 minim is equivalent to 1 grain of the powder. This may be given in milk or peppermint-water to cover the disagreeable taste.

Iodism is a term applied to the general condition produced by the use of iodin in too large a quantity. Among the signs are catarrhal inflammation of the air-passages, sore throat, hoarseness, headache, salivation, and fever.

Antitoxin is a curative serum, consisting of the blood-serum of animals which have been rendered immune from infectious diseases by injection of the specific toxin of those diseases. Of these the most valuable are the diphtheria and tetanus antitoxins.

Lanolin is an emollient preparation made from fats obtained from sheep's wool and used as a base for various external applications.

Glycerin (*glycerinum*) is a clear, syrupy liquid obtained by the decomposition of animal or vegetable oils. It is antiseptic and emollient in action, abstracts fluid from the tissues, and is freely absorbed by the skin and mucous membrane. Internally in large quantities it acts as a laxative. It is used as a vehicle for many other drugs.

Vaselin (*petrolatum*) is the commercial name for a preparation obtained from petroleum by distillation. It is used as an emollient and protective dressing in skin irritation and as a base for ointments.

Albolene is a refined product of petroleum. It is used as a basis for ointments or in liquid form to dissolve various drugs used for sprays.

Witch hazel (*hamamelis*) is made from the leaves of the shrub *hamamelis virginiana*. It is said to be astringent, styptic, and sedative. It is used internally and externally and is valuable in venous congestion and local inflammation. It is said to have special value as an application in hemorrhoids, varicose veins, and ulcers. Pond's Extract is a proprietary remedy, said to contain the active principles of the plant.

Arnica, in its various preparations and doses, acts as an irritant, stimulant, depressant, antipyretic, and diuretic. The tincture of arnica in water is much used as a local application in case of sprains or bruises. It prevents the swelling and discoloration caused by bruises, but may cause great irritation of the skin and eczema. It should not be used if the skin is broken.

Ergot (*ergota*) is obtained from a fungus growth on rye, wheat, and other grains. It has a wide field of application, but is chiefly used to promote uterine contractions after childbirth and to check hemorrhage.

Linseed (*linum*) or **flaxseed** is used internally to promote expectoration and diuresis, and as a demulcent in coughs or sore throat.

Linseed tea is made by pouring 1 pint of boiling water over 3 tablespoonfuls of flaxseed. Licorice root, in the proportion of 1 ounce to this quantity, or sliced lemons and sugar are sometimes added. The preparation is kept hot, but not allowed to boil, for one hour and then strained. The patient is allowed to sip freely to relieve cough. It is also used in cases of bladder irritability.

Linseed oil is used occasionally as a remedy for hemorrhoids, as a dressing for old varicose ulcers, by enema as a laxative, and, less frequently, by the mouth. Ground linseed meal is considered the best substance for poultices.

Lime liniment (*carron oil*) consists of equal parts of linseed oil and lime-water, well shaken. It is a favorite remedy for burns.

Lime (*calcium oxid*) is an important constituent of the body. It gives firmness to the bones and is also found in

solution in the tissues. Internally it acts as slightly sedative to the mucous membrane, and as an antacid and astringent. Calcium chlorid is used to promote coagulation of the blood.

Lime-water (*liquor calcis*) is a solution of lime in water. This rapidly decomposes by exposure to air. It is used as a saturated solution and is quickly made by pouring about 2 quarts of water over a piece of fresh unslaked lime the size of an egg. It should be stirred till slaked and let stand till it is clear. The water is then poured off. The milky sediment will settle to the bottom, but this sediment should never be given. It is used as a gastric sedative, and is added to milk to prevent the formation of dense indigestible curds in the stomach. The dose is usually about 2 tablespoonfuls to 1 glass of milk.

Camphor is obtained from trees growing in China, Japan, and other eastern countries. It is used internally as a sedative in hiccough, hysteria, and other nervous affections. Inhaled, it acts as a stimulant to the heart and respiration. It is also used as a remedy for influenza, either inhaled or taken by mouth. Externally it acts as a sedative. It is contained in many liniments, and is frequently applied in case of sprains, lumbago, neuralgia, and other local affections.

Hops (*humulus*) act as a bitter tonic and promote sleep, and have a diaphoretic and astringent action. Externally, hops are used as a poultice for the relief of pain by pouring hot water over the leaves. Made into pillows, fresh hops are occasionally used for their sedative effect by nervous invalids.

Capsicum (*Cayenne pepper*) is used in flatulent colic to relieve pain; in alcoholic and opium cases as a substitute for those drugs. It increases saliva, promotes digestion, acts as a stimulant to the heart, also as a diaphoretic and diuretic. Externally it acts as a rubefacient and vesicant. It is irritant to the mucous membrane and in too large doses may excite gastritis.

Ginger (*zingiber*) acts as a stimulant, assists in the ex-

pulsion of gas from the stomach and bowels, produces a sense of warmth in the stomach and abdomen, and relieves pain in those regions.

Mustard (*sinapis*) is used internally chiefly as a condiment, an emetic, and occasionally to expel gas from the intestines. Externally it is used as a rubefacient, counter-irritant, and nervous stimulant. It causes heat, redness, severe pain, and, if the application is prolonged, vesication.

Turpentine (*terebinthina*) is used externally, chiefly as a rubefacient and antiseptic. Internally it has a varied action. It is given in cases of ulceration and hemorrhage of the intestines, to relieve flatulent colic, and in cases of bronchitis.

Oil of turpentine (*oleum terebinthinæ*), commonly called *spirits of turpentine*, is the preparation most frequently used.

Sanitas is a watery solution of turpentine which contains camphor and other ingredients. It is used as an external disinfectant.

COMMON POISONS AND THEIR ANTIDOTES

Poisons may be divided into two classes—irritants and narcotics.

Irritants act quickly as soon as they enter the alimentary tract, causing burning and destruction of tissue and severe pain.

Narcotics act more slowly, as they must be absorbed and enter the circulatory system before producing their effect. They produce drowsiness, passing gradually into unconsciousness, and ending in death.

General Treatment of Poisoning.[1]—"After determining the nature of the poison, the first indication is to administer a *chemical antidote* so as to prevent any further action of the noxious agent on the organism. Unless there has already been free vomiting or there is evidence of severe corrosion, the stomach should be evacuated without delay

[1] From "Pocket Therapeutics and Dose-Book," Morse Stewart, Jr., M. D.

either by means of the *stomach-pump* or the administration of an *emetic*. In the majority of cases the pump should be given the preference, as it causes less exhaustion and is more prompt and reliable in its action. The best emetics are copper sulphate, 5 gr.; zinc sulphate, 10 gr.; powdered ipecac, 20 gr.; common salt, 2 drams to a pint of water; mustard flour, 2 drams in a cup of warm water; and apomorphin hydrochlorid, $\frac{1}{10}$ to $\frac{1}{8}$ gr., hypodermically. The last is especially valuable in narcotic poisoning, when stupor renders the administration of drugs by the mouth difficult or impossible. In poisoning by all irritant substances *demulcents* are also indicated. They soothe and protect the injured mucous membrane. The best representatives of this class are white of egg, starch-water, flaxseed-tea, gelatin, milk, and oil. Oily demulcents should be avoided, however, when the poison is phosphorus or cantharides, since absorption of these agents is facilitated by fatty matter. *Cathartics* should be employed whenever there is reason to believe that any of the poison has entered the intestinal canal. As a rule, the best are magnesium sulphate and castor oil.

"If the poison has been absorbed, remedies are given and measures are employed to counteract its effect on vital processes (*physiologic antidotes*). Thus, in failure of the respiration it may be necessary to give atropin, ammonia, strychnin, or caffein hypodermically, to employ artificial respiration, and to administer oxygen; in case of syncope or collapse, to apply external heat, to administer diffusible cardiac stimulants, and to inject normal salt solution under the skin or into a vein; or if there be violent convulsions, as in strychnin-poisoning, to give sedatives, like chloral, bromids, amyl nitrite, and chloroform."

POISONS—SYMPTOMS, ANTIDOTES, TREATMENT

Poisons.	Symptoms.	Antidotes, Treatment.
Acetanilid. Antipyrin. Phenacetin.	Cyanosis; livid, anxious face; cold sweat; feeble pulse; shallow breathing; prostration; asphyxia.	Cardiac and respiratory stimulants: ammonia, caffein, strychnin; artificial respiration; oxygen inhalation; external heat.
Acid, acetic	Great heat and burning pain in stomach; convulsions; death.	Magnesia, magnesium carbonate, with cream or water; soap; alkalies.
carbolic	Burning sensation from mouth to stomach; gastric pain; vomiting of frothy mucus; cold, clammy skin; difficult, rapid, and superficial breathing; insensibility; pupils contracted; odor perceptible on breath.	Diluted alcohol or whisky (3 to 4 ounces); immediate lavage of stomach; magnesium or sodium sulphate; lime-water with sugar; demulcent drinks; opium for pain; stimulants; external heat.
carbonic	Great drowsiness; giddiness; difficult respiration; loss of muscular power and sensibility; coma, face and body swollen and livid; eyes prominent.	Remove patient to fresh air; elevate the head; cold affusions; stimulating frictions to thorax and extremities; artificial respiration; oxygen inhalation.
hydrochloric. nitric. nitrohydrochloric. sulphuric.	Sense of burning in throat and stomach; styptic taste in mouth; thirst; eyes red and sparkling; frequent, tense pulse; hot, dry skin; tongue red and glazed; lips black; croupy cough; great inflammation of abdominal viscera; vomiting of blood and yellow matter smelling of acid; cold sweats; delirium.	Alkalies; plaster from the walls; common soap, followed by copious draughts of tepid water or flaxseed tea, except where sulphuric acid has been taken; demulcents; carbonates of magnesium or calcium; if patient survives first effects use antiphlogistic remedies for inflammation.
hydrocyanic. prussic. cyanid of potassium.	Large doses, immediate death; in smaller doses, pain in head, stupor, nausea, faintness, vertigo, dilated pupils, loss	Sodium hyposulphite; artificial respiration; stimulants, like atropin and strychnin.

POISONS—SYMPTOMS, ANTIDOTES, TREATMENT (*Continued*)

Poisons.	Symptoms.	Antidotes, Treatment.
Acid, hydrocyanic (*continued*).	of sight, difficult respiration, vibrating pulse, and collapse. The odor of the acid is strongly exhaled; death from paralysis of respiratory center.	
oxalic	Burning heat in stomach; sometimes vomiting or retching; great prostration; spasmodic respiration; convulsions.	Mixtures of magnesia; whiting, chalk, or plaster from the walls; carbonates of magnesium or calcium.
Aconite. Veratrum viride.	In large doses causes much excitement; confusion of the intellect; respiratory movements slow, irregular, and stertorous; gastric pain; nausea; great muscular weakness; cold body, tongue, and breath; skin covered with a profuse sweat; vomiting and retching with veratrum; pulse almost indistinguishable.	Animal charcoal; opium; stimulants by mouth and rectum; warmth; friction; vegetable astringents; tannin; digitalis; galvanism; stomach to be carefully washed out and the subsequent symptoms met and combated; keep patient in recumbent position; give cathartics; ammonia and morphin hypodermically; warmth and friction to body.
Alcohol	In small quantities, mere excitement; in large doses, confusion of intellect, followed by somnolence and coma; may be mistaken for epilepsy or apoplexy.	Evacuate stomach by emetics, apomorphin the best, repeated at short intervals; aromatic spirits of ammonia; cold douche; galvanism; stimulate respiratory movements; strong coffee.
Alkalies. Ammonia. Potassa. Soda.	Excoriation of mouth and fauces; burning in stomach; vomiting and purging often of bloody matters; surface cold and clammy; pulse quick and feeble; sense of strangulation.	Diluted acetic acid; vinegar; oil; demulcents copiously; when vapor of ammonia has been inhaled, fumes of vinegar should be inspired; opium and stimulants.
Antimony	Nausea; severe vomiting; hiccough;	Astringent infusions containing tannin,

Its salts.	cardialgia; burning heat at epigastrium; colic and purging; small rapid pulse; cold skin; syncope; difficult respiration; vertigo; great prostration.	oak bark, strong tea or coffee; oily warm liquids; galls; stimulants; albumin; mucilage; opium; use the stomach-pump if necessary.
Arsenic.................. Its compounds.	Metallic taste; great flow of saliva; nausea and vomiting; fainting; great thirst; sense of heat in stomach; much gripping, tenesmus, and purging; stools dark and offensive; urine scanty, high colored; pulse small, frequent; labored respiration; cold sweats; prostration; delirium; convulsions.	Ferric hydroxid, freshly prepared by precipitating a solution of ferric chlorid or ferric sulphate with sodium carbonate or ammonia; magnesia; emetic or stomach-pump, if necessary; albumin, oil, and lime-water; abundant draughts of sweet milk, gruel; afterward combat inflammatory symptoms; alcoholic stimulants and opium.
Barium.................. Its salts.	Those of irritation combined with an affection of the brain and nervous system, as vertigo, convulsions, paralysis; burning in stomach, griping, and vomiting.	Epsom or Glauber salts; diluted sulphuric acid; oils; emetics, and stomach-pump.
Belladonna............... Atropin.	Dryness and redness of the mucous membrane of the throat, mouth, nose, larynx, and tongue; pupils dilated; impaired vision; thirst; feverishness; flushed face; great weakness; hurried breathing; delirious excitement; convulsions; coma.	Tannic acid; wash out the stomach or administer apomorphin hypodermically; caffein, strychnin hypodermically; artificial respiration; catheterization.
Bromin..................	Irritation and inflammation of the parts with which it comes in contact; violent gastritis; depression; collapse.	Immediate and free use of starch, albumin, gelatin; ammonia; sodium carbonate or bicarbonate.
Cannabis indicus..........	Induces cataleptic state; pupils dilated; delirium; vertigo; stupor.	See *Opium*.
Cantharis................	Burning sensation in throat; violent pain	Emetic or stomach-pump; demulcents

POISONS—SYMPTOMS, ANTIDOTES, TREATMENT (*Continued*)

Poisons.	Symptoms.	Antidotes, Treatment.
Cantharis (*continued*).	in stomach and bowels; nausea; vomiting; purging; ejections frequently bloody and purulent; great heat and irritation of urinary organs; painful priapism; pulse quick and hard; convulsions; delirium and syncope.	(linseed-tea, albumin, gruel, starch paste, gelatin); opium for pain; avoid fats and oils, as they favor absorption of the poisonous principle.
Carbon monoxid. Illuminating gas.	See *Carbonic acid.*	
Chloral, hydrated	Gastric irritation; nausea, vomiting; profound narcotism; respirations slow and shallow; pulse weak, rapid, and irregular; complete muscular relaxation.	Evacuants as emetics; maintain temperature by artificial heat and friction; atropin and strychnin hypodermically; hot enemas of black coffee; intravenous injections of normal salt solution; inhalations of oxygen; avoid alcohol.
Chlorin	Great and painful constriction of the throat; sensation of suffocation, alternating with asphyxia; if protracted, laryngeal and pulmonary inflammation; odor of gas perceptible in breath and vomited matter.	Free use of albumin; magnesia with mucilaginous drinks; inhalations of ammonia.
Chloroform	Sudden pallor of face; lividity and gasping for breath; pulse feeble and irregular; great muscular relaxation; relaxation of sphincters; death occurs very suddenly as a result of heart failure.	Head low; artificial respiration; external heat; adrenalin intravenously; strychnin, atropin, caffein hypodermically; oxygen inhalations.
Colchicum	Heat in epigastrium; nausea, vomiting; depression of circulation; acute ab-	Tannin; emetics or use of stomach-pump, demulcents (oil, gelatin, starch, muci-

	dominal pain; watery discharges; suppression of urine; feeble pulse; cold sweats and coldness of extremities.	lage, albumin); opium; stimulants; external heat.
Conium	Paralysis of voluntary muscles, those of the inferior extremities first affected; vertigo; respiration slow and labored; bodily temperature lowered.	Stimulants; artificial respiration; cathartics; atropin and strychnin have been recommended as antidotes; tannin; external heat.
Copper... Its salts.	Violent headache; vomiting; pain in bowels; cramps of lower extremities; a peculiar coppery taste; diarrhea; convulsions; palsy; insensibility; quick pulse, cold extremities.	Vomiting to be promoted by copious draughts of warm water; milk, mucilaginous fluids; albumin, tea, coffee; oak bark infusion; ferrocyanid of potassium followed by emetics.
Croton oil	Sense of heat, pain, and nausea, followed by tormina, watery stools, violent catharsis, prostration, collapse, acute inflammation of intestines.	Emetics; demulcent drinks; opium; stimulants.
Digitalis	Vomiting and purging; an infrequent pulse, followed by a frequent, irregular, feeble pulse; shallow respiration, dilated pupils; delirium and collapse.	Horizontal position is imperative; tannic acid or astringent infusions; diffusible stimulants; external heat; lavage of stomach; emetics should be avoided.
Ergot and ergotin	Has an irritant action on the intestinal tract causing pain, vomiting, and occasionally purging; dilated pupils; dimness of vision; stupor giddiness. Chronic poisoning is marked by gangrenous or convulsive conditions.	Diffusible stimulants; hot applications to surface; tannic acid; demulcent drinks; digitalis to support the heart's action.
Formaldehyd solution	Burning in throat and stomach; vomiting; diarrhea; feeble breathing; vertigo, albuminuria; collapse.	Water or spirit of ammonia is a definite antidote; emetics; demulcents; opium.
Gelsemium	Gait at first staggering, afterward loss of muscular movement; diffused numb-	Tannic acid; emetic or lavage of stomach; external heat; artificial respiration;

POISONS—SYMPTOMS, ANTIDOTES, TREATMENT (*Continued*)

Poisons.	Symptoms.	Antidotes, Treatment.
Gelsemium (*continued*).	ness over body; eyelids closed; pupils widely dilated and do not respond to light; respirations shallow, labored, and irregular; heart's action weak and intermittent; death from asphyxia; consciousness is preserved until near the close.	diffusible stimulants; morphin and atropin hypodermically.
Gold	See *Mercury*.	
Hyoscyamus	Similar to belladonna.	Similar to belladonna.
Iodin. Its compounds.	In large doses causes heat and sense of constriction in fauces; nausea; offensive eructations; pain in stomach; retching; colic; diarrhea; quickness of pulse; thirst; salivation; convulsions; cephalalgia; vertigo; tremors.	Starch or wheat flour well mixed with water; afterward vinegar and water; cathartics; mucilaginous fluids; antiphlogistics for the inflammatory symptoms as they occur.
Iron. Its salts.	Large doses of soluble preparations give rise to nausea and vomiting, purging; and abdominal pain.	Carbonate of sodium; mucilaginous drinks; alkaline carbonates; magnesia; overcome the ensuing constipation by cathartics.
Lead. Its salts.	Obstinate constipation; violent colic; retraction of the abdomen; vomiting; small hard pulse; labored breathing; tremors; gums with a blue tinge; paralysis of extremities.	Epsom or Glauber salts; almond or olive oil; alum; albumin; diluted sulphuric acid; iodid of potassium in the chronic form; opium to relieve pain and relax spasm.
Lobelia	If vomiting does not occur the nervous system is affected; muscular weakness; trembling; slow respiration; coldness	Wash the stomach out with solution of tannic acid; treat the collapse by stimulants; sinapisms; friction; anodynes.

	of surface; enfeebled circulation; insensibility; sometimes convulsions.	
Mercury. Its salts.	Those of corrosive sublimate resemble those of arsenic, only more immediate and violent; evacuations are frequently bloody; whitened condition of epithelium of mouth; violent irritation of the alimentary canal; vomiting; purging; pain in stomach; corrosion of mouth, tongue, and palate.	Produce vomiting if it does not exist; albumin followed by astringent infusions; wheat flour and water followed by emetics; avoid the use of the stomach-pump.
Nitroglycerin. Nitrite of amyl.	Long and persistent headache; a fulness and hammering in the temporal regions; vertigo; quickened pulse; dyspnea; muscular weakness and tremors.	Cold affusions; artificial respiration; hypodermic injections of strychnin, atropin, ammonia; treatment generally symptomatic.
Nux vomica.	See *Strychnin*.	
Opium.	Dark, suffused countenance; drowsiness; stupor; perfect insensibility or profound coma; then pallid countenance; slow respiration; deep and stertorous breathing; cold sweats; slow, full pulse; cold and livid skin; suspension of all secretions except that of the skin; pupils minutely contracted, insensible to stimulation; at length pulse frequent, feeble, and threadlike; sometimes convulsions, particularly in children.	Evacuate stomach by means of stomach-pump as soon as possible; counteract tendency to sleep by strong tea, coffee, or irritation of any kind to surface; keep the patient constantly in motion; cold water to head and shoulders; galvanism; vegetable astringents or potassium permanganate; atropin, strychnin, caffein hypodermically; cathartics; active stimulation; artificial respiration.
Phosphorus.	Matchy or oniony taste in mouth; acrid burning sense in throat and stomach; nausea; vomiting; pulse small and fre-	Copper sulphate as emetic and chemical antidote; hydrated magnesia, potassium permanganate, lime-water also recom-

POISONS—SYMPTOMS, ANTIDOTES, TREATMENT (*Continued*)

Poisons.	Symptoms.	Antidotes, Treatment.
Phosphorus (*continued*).	quent; vomited matter of a dark color emitting white fumes; jaundice.	mended as antidotes; saline cathartics; opium. All oily substances must be avoided.
Picrotoxin	See *Strychnin*.	
Pilocarpus	Profuse perspiration; cold clammy body and extremities; salivation; diarrhea; general and alarming depression.	Tannic acid; emetics; atropin hypodermically best antidote; diffusible stimulants; external heat.
Potassii bichromas	Burning in mouth, throat, and stomach; excessive and painful vomiting of bloody mucus; convulsions; palsy.	Carbonate of potassium or sodium; chalk or magnesia, in connection with milk or albumin; emetics.
Silver. Its salts.	Excites violent gastro-enteritis; symptoms of an irritating poison.	Common salt given freely in solution to act as emetic as well as an antidote; albumin; tannin.
Stramonium	See *Belladonna*.	
Strychnin	Convulsions; when a paroxysm occurs a shudder passes through the whole system; head and extremities jerk and twitch; then suddenly a general convulsion takes place—the limbs extended, hands clenched, toes and feet incurved, head bent backward, body arched, muscles hard and rigid; countenance assumes a ghastly grin.	Tannic acid in solution; potassium bromid, ʒj to ʒij, and chloral, gr. 20, by enema, if necessary; no attempt should be made to wash out stomach until convulsions have been checked by chloroform inhalations.
Tobacco	Trembling with clonic spasms; giddiness, delirium; cold sweats; skin cold and clammy; gastric irritation; catharsis.	Castor oil; stimulants; opium; digitalis; strychnin; ammonia inhalations; friction and artificial respiration.

Turpentine	Heat in stomach; colicky pains; cramps; exhalations having its odor; disturbed state of intellectual functions; irritation and inflammation of intestinal tract.	Emetics, diluents, demulcents; opium to counteract local irritation and cerebral symptoms.
Vegetable irritants Aloes. Capsicum. Castor seed. Colocynth. Elaterium. Gamboge. Jalap. Mezereum. Podophyllum. Savin. Scammony. Tansy.	Many of these articles act especially on the bowels, and in moderate doses are advantageously used as cathartics. In large doses they cause violent catharsis, with great irritation of the stomach and bowels.	Expel poison as promptly as possible by means of emetics; copious warm demulcent drinks; stimulants or narcotic medicines, according to circumstances; opium for the pain and intestinal irritation.
Veratrum	See *Aconite*.	
Venomous snake-bites	Sharp pain in wound, later on extending over limb and body, first pale, then red and swollen; faintings, convulsions; small frequent irregular pulse; difficult breathing; cold sweats.	Place tight ligature above point of bite; leave wound to bleed and augment by sucking; cauterize by means of caustics; ammonia freely; free alcoholic stimulation; warm drinks.
Poisonous mushrooms	Nausea; heat and pain in stomach and bowels; vomiting and purging; thirst; convulsions and faintings; pulse small and frequent; stupor; dilated pupils; cold sweats.	Brisk emetic, then Epsom salts; atropin in full doses hypodermically; alcoholic stimulants; external heat.

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SECTION VI
DIETETICS

CHAPTER XXXVIII

THE PRINCIPLES OF NUTRITION

"THE nutrition of the body involves four distinct processes:

"1. The secretion of digestive fluids and their action upon food in the alimentary canal.

"2. The absorption of the ingredients of the food when digested into the blood-vessels and lymphatic vessels.

"3. The assimilation of the absorbed nutritious products by the tissues.

"4. The elimination of waste material" (Thompson).

Foods are substances which supply the living organism with the elements necessary for growth and repair, and with the energy needed for the exercise of its functions.

A food, to be complete or perfect, must of necessity contain all the elements of which the tissues, fluids, and solids, of the body are composed.

In the lessons on anatomy and physiology it was found that from fifteen to twenty chemical elements are found in the body, of which the most important are oxygen, hydrogen, carbon, nitrogen, calcium, phosphorus, and sulphur.

Water constitutes about 60 per cent. of the body weight and is an important element of food, though it cannot be burned in the body and does not yield energy.

The uses of water in the body are:

1. It renders the tissues soft, elastic, and flexible.
2. It dissolves nutritive material and conveys it in fluid form to the various parts of the system.
3. It assists in the distribution and regulation of the heat generated in the body.
4. It assists in dissolving and carrying off waste material.
5. It moistens the skin and surfaces and acts as a lubricant, preventing friction.

Food Compounds.—The various elements of the body are combined so as to form a variety of compounds, which exist also in foods, and serve in building and repairing the tissues, supplying heat and muscular force or energy, or the power to work. The most important food compounds are:

1. Proteins.
2. Carbohydrates.
3. Fats.
4. Mineral matter.
5. Water.

Nitrogen.—Of all food elements, nitrogen stands first in importance. It is an essential constituent of all living things. Activity and change which distinguish living from inanimate things are only found where nitrogen is present. Hence, foods are frequently classified as nitrogenous and non-nitrogenous.

Nitrogenous foods furnish the greater part of the material needed for tissue building.

Non-nitrogenous foods contribute to the production of heat and force.

Foods are also classified as organic and inorganic, the organic including foods derived from the vegetable or animal world; the inorganic including mineral foods, such as water, salt, phosphorus, etc. It should be remembered that foods are often classified according to their most important ingredients, while they contain many other elements. Also that nitrogenous foods do contribute to

a certain extent in producing heat and force, but tissue building and repair are their chief functions.

Alimentary Principles.—It has been stated that foods are often classified according to their chemical ingredients or compounds (which are often spoken of as alimentary or food principles) into proteins, carbohydrates, fats, minerals, and water.

1. **Proteins** is a term used to include the principal nitrogenous compounds, whether animal or vegetable.

Animal Nitrogenous Substances.—The principal animal nitrogenous substances are:

Albumen, found in the white of an egg.

Casein, found in milk.

Fibrin, found in the blood.

Myosin, found in the muscle.

Gelatin, found in the bone and ligaments.

Vegetable Nitrogenous Substances.—The principal are:

Gluten, found in all cereal grains (sometimes called vegetable fibrin).

Legumin, found largely in peas and beans.

2. **Carbohydrates** or **non-nitrogenous foods** include all starches and saccharine substances used as food.

Starch is found in many vegetables.

Sugar is found in plants as cane- or beet-sugar, also in animals as sugar of milk (*saccharum lactis*), a crystallized sugar obtained by evaporation from whey.

3. **Fats** or **hydrocarbons** are obtained from both the animal and vegetable kingdom.

Fats occur chiefly in animal foods, of which cream, butter, meat, etc., are examples. They are also found in the vegetable world, of which olive oil and cotton-seed oil are examples. Fats also exist in the yolks of eggs, in some cereals, notably oatmeal, and in various nuts.

4. **Mineral substances** include water and salts, are found in a great variety of foods, and form about 60 per cent. of the body weight. Phosphate of lime or calcium phosphate is an essential element of bone. Fresh lean meat and fish contain about 1 per cent. of mineral matter.

Milk yields a very small portion of mineral substance. Cereals and green vegetables and fruits range up to 2 per cent., while dried peas and beans contain from 3 to 4 per cent. of mineral matter.

Tissue-building foods:

Milk.	Fish.	Peas.
Eggs.	Cheese.	Lentils.
Meat.	Beans.	Peanuts.

Heat- and force-producing foods:

Cereals.	Potatoes.	Fats.
Corn.	Tapioca.	Sugar.
Rice.	Sago.	Honey.

Vegetables containing little or no starch:

Cabbage.	Parsnips.	Lettuce.
Asparagus.	Turnips.	Radishes.
Spinach.	Egg-plant.	Onions.
Celery.	Artichokes.	Rhubarb.
Green beans.	Tomatoes.	Cauliflower.
Squash.	Cucumbers.	Fruits.

ENERGY REQUIREMENTS FOR NORMAL ADULTS

Usual physical condition of the individual.	Calories per kilogram per day.
At rest	30–35
Light exercise	35–40
Moderate exercise	40–45
Heavy muscular work	45–60

ENERGY REQUIREMENTS FOR NORMAL CHILDREN

Age.	Calories per day.
1–2	900–1200
2–5	1200–1500
6–9	1400–2000
10–13	1800–2200
Girls: 14–17	2200–2600
Boys: 14–17	2500–3000

(Von Noorden's allowance.)

In many respects the human body resembles an engine and is often spoken of as the human machine. In common with other machines it must have material, first, to build

it; second, to repair its several parts as they are worn out; third, to serve as fuel. Every thought, feeling, and motion of the body contributes to the waste of tissue, and requires that some tissue-building substances be supplied. Besides this, there is a certain amount of waste of tissue and energy in keeping alive. Every heart-beat, every breath, the processes of digestion and excretion—all require new material to repair the loss produced in the exercise of these functions.

The human body, unlike other machines, builds itself, repairs itself, and regulates its functions while in health. It can, when necessary, use its own material as fuel to produce heat. Excess of food beyond what the body needs is converted into fat and stored in the system.

When coal is supplied to the engine, the energy or power latent in the coal is changed into heat and power needed for work. When food is supplied to the human body the same change takes place. The food is burned in the body by its contact with oxygen in the tissue, and the process is termed oxidation. Just as different kinds of coal or wood produce different quantities of heat and power when burned in an engine, so different foods have different heat- and force-producing properties. In chemical laboratories this power is measured by a special apparatus called the calorimeter. The unit of measure is a calorie. A calorie or heat unit is the amount of heat required to raise 1 pound of water 4° F.

Refuse.—Almost all food substances contain a certain amount of refuse. Some of this refuse has little or no nutritive value. Some cannot or should not be eaten, as, for instance, the seeds and skins of vegetables and fruits. Vegetables contain little real nourishment in proportion to weight, and are not valuable for persons with weak digestive organs. They contribute to the salts, acids, and water needed in the body and afford a pleasing variety. Also the woody or tough fiber in many vegetables, while indigestible, performs a useful function in contributing to the bulk of food needed for normal peristalsis.

The Tests of a Perfect Food.—"1. A perfect food must contain all the nutritive elements of the body: Proteins, carbohydrates, fats, minerals, and water.

"2. It must contain these in their proper proportions.

"3. It must contain in a moderate compass the total amount required daily.

"4. The nutritive elements must be capable of easy absorption, and yet leave a certain bulk of unabsorbed matter to act as intestinal balance. It must be obtainable at a moderate cost" (Hutchison).

No one food fulfils all these requirements, hence, the necessity of a mixed diet whereby one food may be used to supplement what is lacking in another. "The foods best for health are those best fitted to the needs of the individual. The cheapest food is that which furnishes the largest amount of nutriment at the least cost. The best food is that which is both most healthful and cheapest."

The **laws which govern nutrition** are not yet fully understood, but "the general metabolism or food exchange and use in the animal organism is now sufficiently well understood to admit of many safe and important conclusions.

"It is necessary to measure both the income of the body, that is, the food plus water and oxygen, and also the outgo, that is, the excretions which are practically all included in what passes out through the lungs, the skin, the kidneys, and in the feces.

"Recently it has become possible to measure the oxygen consumed in breathing. . . . For measuring the carbon dioxid and water excreted a special apparatus has been devised which measures the oxygen consumed and the heat given off. This apparatus is known as a respiration calorimeter.

"The *respiratory quotient* is obtained by dividing the volume of carbon dioxid evolved by the volume of oxygen used.[1]

Food accessories or *adjuncts* comprise the condiments

[1] W. H. Jordan, The Principles of Human Nutrition.

which give flavor to food or stimulate the digestive secretions, and such beverages as tea, coffee, cocoa, etc.

Proteins is a term used to include the principal nitrog enous foods.

Albuminoids is a term used to include substances similar to the white of egg (albumen), the lean of meat (myosin), the curd of milk (casein), and the gluten of wheat, albumen being taken as the typical member of the group.

Gelatinoids is used to include the substances obtained from bone, tendons, gristle, etc.

Proteids is a term which includes gelatinoids and albuminoids.

Extractives is a term used to denote the ingredients found in meat extracts, broths, etc.

Dextrose, *glucose*, or *grape-sugar* is found in grapes, honey, and sweet fruits.

Cellulose is the basis material of the more or less solid framework of plants.

Dextrin is a substance formed as an intermediate product in the transformation of starch into sugar.

Lactose is the form of sugar found in milk.

CHAPTER XXXIX

THE PRINCIPLES OF NUTRITION (*Continued*)

The **nutritive value of food** depends not only on the proportion of nutrients contained in it, but on the amount which the body can appropriate. It is not the amount that is eaten, but the amount that is digested and assimilated that becomes nutriment for the body. Individuals differ greatly in the amount of nutriment they are able to appropriate.

The exact nutritive or caloric value of any food is of very much less importance to a nurse than the general relative value of foods. For instance, if a nurse were in charge of a patient in a family who with difficulty secured the necessities of life, it would be exceedingly foolish for her to spend money for celery or lettuce out of season, which might please the palate, but which have almost no nutritive value, when the money was needed for foods which would properly nourish. It is important for her to know that though the patient may like tea and coffee, those substances do not take the place of milk as food. It is important also for her to understand that while grape-juice or beef-broth may both be refreshing and relished, the proportions of nutriment contained in either is very small, and in the latter, especially, is a very variable quantity.

The **ideal diet** has been defined as that combination of foods which, while imposing the least burden on the body, supplies it with exactly sufficient material to meet its wants.

Mixed Diet.—In the ordinary individual, who has had the general comforts of civilization, the appetite revolts against a monotonous or one-sided diet. Thus, it has become customary to supply the nutrients from a variety of articles at each meal. It will also be recognized that

either instinct or custom has suggested many suitable combinations of common foods. For instance, bread contains protein and carbohydrate substances, but no fats, hence, we instinctively combine it with butter, which supplies the needed fat. Potatoes contain much starch and little nitrogenous material, hence, they are frequently combined with meat, milk, and eggs. Rice, which is largely starch, is combined, in cooking, with milk, which supplies elements in which it is lacking.

Amount of Foods Required.—There are many things which enter into the question as to the amount of food needed, and also the proportions in which we should use the proteins, the carbohydrates, and fats.

Prominent among these are:

1. Age.
2. Size.
3. Body weight.
4. Degree of activity or exercise taken.
5. Sex.
6. Climate and season.
7. Appetite and general condition.
8. Idiosyncrasies.

Age is one of the greatest determining factors. There are generally recognized three great divisions in human life:

The age of growth and development.

The period of adult life.

The period of advanced age.

The *age of growth and development* begins at birth and continues for about eighteen years. This may be divided into three periods: The period of infancy, from birth to two years; the period of childhood, from two to ten years; and the period of adolescence. Up to the age of one year the infant's diet should be practically restricted to milk. Occasionally, it may seem necessary to add other food substances but, on general principles, milk is recognized as a complete food for infants. In the second year, a few

other carefully selected articles of diet are added, usually some well-cooked starchy substance, bread, meat juice, and broths. By the end of the second year the digestive functions have increased in power, teeth for mastication have been developed, and all the digestive organs are becoming adapted for a mixed diet. During the period of rapid growth the child needs more tissue-building food than in advanced age. Mineral salts are needed in large proportions. Fruits supply these, and nearly all young children crave sugar, which should be provided in moderation. Thompson gives the following list of foods which should be forbidden all children under four years of age: Fried food of all kinds; game; salt food; pork; pickles; salads; condiments, except salt; stew; the dressing of fowl; sauces; visceral food, such as liver, kidney, etc., all raw vegetables; potatoes, except baked; tomatoes in any form, the coarser vegetables, such as beets, turnips, cabbage; fancy breads; cake and pastry; griddle-cakes; canned food of all kinds; fancy confectionery; sweets and preserves; cheese; rich soups; dried or unripe fruits; nuts; fruit with large seeds, such as grapes; the skin of all poultry, fruits, or vegetables; tea; coffee; and alcohol in every form. He also gives the following general rules for feeding young children:

"1. Allow time for meals.

"2. See that the food is thoroughly masticated.

"3. Do not allow nibbling between meals.

"4. Do not tempt the child with the sight of rich and indigestible food.

"5. Do not force the child to eat against its will, but examine the mouth, which may be sore from erupting teeth; and examine the food, which may not be properly cooked or flavored.

"6. In acute illness, reduce and dilute the food at once.

"7. In very hot weather give about one-fourth or one-third less food, and offer more water."

The quantity of food required increases rapidly from

birth up to four or five years. Between four and ten the increase is very gradual.

From ten to eighteen years of age development of the body is very rapid, and exceptionally large amounts of food are needed during that period. The development and education of the mind goes on through life, and may wisely proceed very gradually, but the development of the body is limited to a certain period, after which it is irrevocably arrested, therefore much care should be given to proper feeding during the years of physical growth.

Throughout active adult life the food, both in character and quantity, should be regulated, to a certain extent, by occupation, habits of life, climate and season, and individual capacity and needs. Most people eat more than the body can assimilate and more than is needed for the repair of waste and the supplying of force, hence, the tendency to excess of fat and diseases caused by imperfect elimination and digestion.

Obesity.—The term "obesity" is used to designate the excessive accumulation of body fat. In the majority of cases the condition is within the control of the individual.

The remedy for obesity in most cases is either less food or more exercise. There are cases of obesity, however, which cannot be explained in the ways mentioned, and in which the reduction of food and increased exercise seem to have little or no influence on body weight.

Diet in Advanced Age.—With advancing age there is a lessening of activity of the organs of the body. As a rule, the ability for muscular exercise grows less. The digestive organs share in the general decline of physical vigor. There is less need for food on account of lessened exercise, and less ability to digest and assimilate food. Slow degenerative changes are taking place in the whole alimentary tract, in common with other organs. These changes make it necessary for changes in the quality and quantity of food used. The ability to eliminate food un-

necessarily consumed diminishes, and excess of foods is certain to result in disease.

The following general rules may, therefore, wisely be observed in arranging a diet for this period of life:

1. To decrease the amount of food consumed.
2. To give small quantities of food at frequent intervals and thus avoid overtaxing the digestive system with a heavy meal.
3. To choose foods that are nourishing and easily digested, and that do not yield an excessively large amount of indigestible residue as waste matter.

Occupation.—The degree of muscular exercise taken should determine to a certain degree the quality and quantity of food. Those who are engaged in sedentary occupations require less food than those whose daily work involves active exercise in the open air.

Temperament and *disposition* influence food requirements. Persons of a sanguine type, being more active, use more energy than the phlegmatic, and the food requirements of these two types differ to some extent.

The *work of the body* includes both the maintenance of its functions and the performance of labor—the one termed "physiologic labor" and the other "mechanical." The relation of food to work is important to remember in studying nutrition.

Climate and Season.—As a rule, in tropical climates and during the hot season less animal foods and more vegetables and fruits should enter into the diet.

Sex.—Women, as a rule, require slightly less food than men.

Personal idiosyncrasy should always be considered. Comparatively few individuals can eat all foods without injury. Peculiarities may be due to inherited tendencies, to the growth of habit, or to other reasons, but they should not be disregarded.

General Rules.—In regulating the diet, two important rules should be observed:

1. Choose foods which agree and avoid those which cannot be digested without discomfort.

2. Use foods in quality and quantity that will supply the nourishment the body needs, and avoid burdening it with excess or superfluous food material which has to be disposed of at the cost of health and strength. Appetite should be regulated by reason. "A meal may be perfectly well balanced and yet not be dietetically correct. In other words, the metal may be in the ore, but the physical machine incapable of extracting it.

"An out-of-door worker, with plenty of oxygen at hand and no hard brain labor, can digest more food and food difficult of digestion, because his blood is not called away from the digestive organs to the brain, than can the man tied to a desk in a heated office, in school, or shop."

The **digestibility of food** may mean several things. It may mean the proportion of a given food, or each of its elements, which can be digested by an ordinary individual.

It may mean to another person the time required to digest or the ease with which it is digested.

It may mean to a third person whether the food agrees or disagrees with the person using it, while to a fourth it may mean due consideration of all these questions.

The actual digestibility of any food is exceedingly hard to determine. All foods contain a certain amount of material which cannot be digested or utilized, and which passes out of the body as waste matter. The ability to assimilate or appropriate food varies greatly. One person will put on flesh, while another will grow thin on the same diet, and approximately the same amount.

Conditions which influence digestibility and assimilation of food:

1. The food which is said to disagree may not have been properly cooked.

2. It may have been eaten with improper combinations.

3. The nervous system powerfully influences the digestive process. The food may be digestible or easy to digest, and yet not be well or comfortably digested because of a peculiar nervous or mental condition.

4. The circulation may be poor. Vigorous healthy circulation promotes food digestion.

5. The blood may be impoverished, and poor material is provided for the secretion of digestive fluids.

6. The consistency of the food eaten has much to do with ease of digestion.

7. The food may not have been well masticated.

Brubaker gives the following table, showing the length of time needed for stomach digestion.

	Hours.	Minutes.
Eggs, whipped	1	20
Eggs, soft-boiled	3	
Eggs, hard-boiled	3	30
Oysters, raw	2	55
Oysters, stewed	3	30
Lamb, broiled	2	30
Veal, broiled	4	
Pork, roasted	5	15
Beefsteak, broiled	3	
Turkey, roasted	2	25
Chicken, broiled	4	
Chicken, fricassed	2	45
Duck, roasted	4	
Soup, barley, boiled	1	30
Soup, bean	3	
Soup, mutton	3	
Liver, beef, broiled	2	30
Sausage	3	20
Green corn, boiled	3	45
Beans, boiled	2	30
Potatoes, roasted	2	30
Potatoes, boiled	3	30
Cabbage, boiled	4	30
Turnips, boiled	3	30
Beets, boiled	3	45
Parsnips, boiled	2	30

The table and chart which follow have a certain scientific interest and value, but the best medical authorities have stated that in practical feeding these tests of food cannot be strictly applied either in health or disease. It

is regarded as "wholly impracticable to prescribe an invalid dietary on a basis of calories as representing energy or heat, or a matter of storage of body substances, as one should definitely prescribe a medicine."

Balanced feeding for farm animals has received very careful study by scientists, and most farmers realize the necessity of properly balanced rations. A large proportion of the American people, however, are accustomed to pay very little attention to food values in arranging their daily dietaries. Human foods are now largely made up of what may be called artificial products (that is, materials so modified by some manufacturing process) that they almost wholly lack nutrients of one or more classes. It is very easy to select a diet that is insufficient for proper body building and repair, while apparently the proper food elements are used.

Artificial Food Products.—Examples of how the food value of a vegetable or animal product may be greatly altered in process of manufacture are easily found.

Wheat flour is one of the staple foods in every family. In making it from the wheat grains the outer coat, or bran, is separated. This outer coat contains much mineral substance, particularly phosphorus, calcium, and magnesium.

Starches and Gums.—In the making of cornstarch, sago, and tapioca certain valuable compounds found in the original plant are removed.

Similar modifications result in the manufacture of sugar from the sugar beet and sugar cane. Butter substitutes are numerous.

Cereal products may be so changed in making into ready-cooked foods that the proportion of nutrient material may be very small and the cost very high.

SEVEN RULES FOR MEAL PLANNING

1. Use a tempting morsel to stimulate gastric secretion.

2. Include fats, proteins, and carbohydrates in proper proportions.
3. Add coarse material to aid digestion.
4. Always include a raw food.
5. Avoid repetition of flavor.
6. Strive for variation in texture.
7. Supply a high point of interest. (Atwater.)

Comparative Cost of Digestible Nutrients and Energy in Different Food Materials at Average Prices:

(It is estimated that a man at light to moderate muscular work requires about 0.23 pound of protein and 3050 calories of energy per day.)

Kind of food material.	Price per pound.	Cost of 1 pound protein.[1]	Cost of 1000 calories energy.[1]	Amounts for 10 cents.				
				Total weight of food material.	Protein.	Fat.	Carbohydrates.	Energy.
	Cts.	*Dolls.*	*Cts.*	*Pds.*	*Pd.*	*Pd.*	*Pds.*	*Cals.*
Beef, sirloin	25	1.60	25	0.40	0.06	0.06	. .	410
" "	20	1.28	20	.50	.08	.08	. .	515
" "	15	.96	15	.67	.10	.11	. .	685
Beef, round	16	.87	18	.63	.11	.08	. .	560
" "	14	.76	16	.71	.13	.09	. .	630
" "	12	.65	13	.83	.15	.10	. .	740
Beef, shoulder clod	12	.75	17	.83	.13	.08	. .	595
" "	9	.57	13	1.11	.18	.10	. .	795
Beef, stewing meat	5	.35	7	2.00	.29	.23	. .	1530
Beef, dried, chipped	25	.98	32	.40	.10	.03	.	315
Mutton chops, loin	16	1.22	11	.63	.08	.17	. .	890
" " leg	20	1.37	22	.50	.07	.07	. .	445
" leg	16	1.10	18	.63	.09	.09	. .	560
Roast pork, loin	12	.92	10	.83	.11	.19	. .	1035
Pork, smoked ham . . .	22	1.60	13	.45	.06	.14	. .	735
" "	18	1.30	11	.56	.08	.18	. .	915

[1] The cost of 1 pound of protein means the cost of enough of the given material to furnish 1 pound of protein, without regard to the amounts of the other nutrients present. Likewise, the cost of energy means the cost of enough material to furnish 1000 calories, without reference to the kinds and proportions of nutrients in which the energy is supplied. These estimates of the cost of protein and energy are thus incorrect, in that neither gives credit for the value of the other.

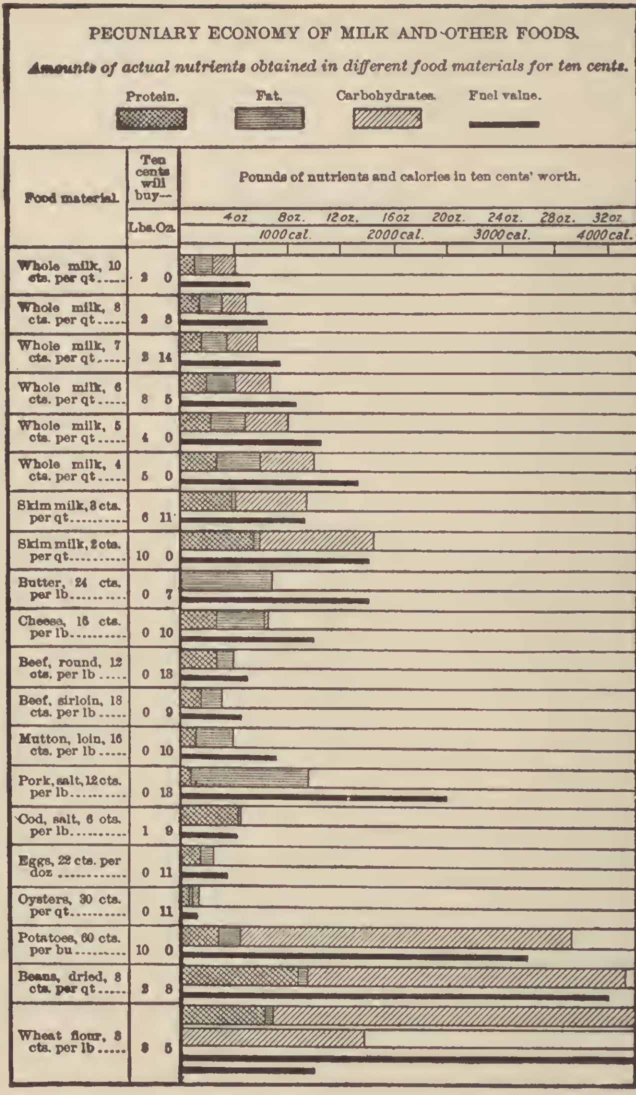
From Bulletin No. 142, United States Department of Agriculture.

Comparative Cost of Digestible Nutrients and Energy in Different Food Materials at Average Prices (Continued):

(It is estimated that a man at light to moderate muscular work requires about 0.23 pound of protein and 3050 calories of energy per day.)

Kind of food material.	Price per pound.	Cost of 1 pound protein.[1]	Cost of 1000 calories energy.[1]	Amounts for 10 cents.				
				Total weight of food material.	Protein.	Fat.	Carbohydrates.	Energy.
	Cts.	*Dolls.*	*Cts.*	*Pds.*	*Pd.*	*Pd.*	*Pds.*	*Cals.*
Pork, fat salt	12	6.67	3	.83	.02	.68	. .	2950
Codfish, dressed, fresh	10	.93	46	1.00	.11	. .	. .	220
Halibut, fresh	18	1.22	38	.56	.08	.02	. .	265
Cod, salt	7	.45	22	1.43	.22	.01	. .	465
Mackerel, salt, dressed	10	.74	9	1.00	.13	.20	. .	1135
Salmon, canned	12	.57	13	.83	.18	.10	. .	760
Oysters, solids, 50 cts. per qt.	25	4.30	111	.40	.02	. .	.01	90
" " 35 "	18	3.10	80	.56	.03	.01	.02	125
Lobster, canned	18	1.02	46	.56	.10	.01	. .	225
Butter	20	20.00	6	.50	.01	.40	. .	1705
"	25	25.00	7	.40	. .	.32	. .	1365
"	30	30.00	9	.33	. .	.27	. .	1125
Eggs, 36 cents per dozen	24	2.09	39	.42	.05	.04	. .	260
" 24 " "	16	1.39	26	.63	.07	.06	. .	385
" 12 " "	8	.70	13	1.25	.14	.11	. .	770
Cheese	16	.64	8	.63	.16	.20	.02	1185
Milk, 7 cents per quart	3½	1.09	11	2.85	.09	.11	.14	885
" 6 " "	3	.94	10	3.33	.11	.13	.17	1030
Wheat flour	3	.31	2	3.33	.32	.03	2.45	5440
" "	2½	.26	2	4.00	.39	.04	2.94	6540
Cornmeal, granular	2½	.32	2	4.00	.31	.07	2.96	6540
Wheat breakfast food	7½	.73	4	1.33	.13	.02	.98	2235
Oat breakfast food	7½	.53	4	1.33	.19	.09	.86	2395
Oatmeal	4	.29	2	2.50	.34	.16	1.66	4500
Rice	8	1.18	5	1.25	.08	. .	.97	2025
Wheat bread	6	.77	5	1.67	.13	.02	.87	2000
" "	5	.64	4	2.00	.16	.02	1.04	2400
" "	4	.51	3	2.50	.20	.03	1.30	3000
Rye bread	5	.65	4	2.00	.15	.01	1.04	2340
Beans, white, dried	5	.29	3	2.00	.35	.03	1.16	3040
Cabbage	2½	2.08	22	4.00	.05	.01	.18	460
Celery	5	6.65	77	2.00	.02	. .	.05	130
Corn, canned	10	4.21	23	1.00	.02	.01	.18	430
Potatoes, 90 cents per bushel.	1½	1.00	5	6.67	.10	.01	.93	1970
" 60 " "	1	.67	3	10.00	.15	.01	1.40	2950
" 45 " "	¾	.50	3	13.33	.20	.01	1.87	3935
Turnips	1	1.33	8	10.00	.08	.01	.54	1200
Apples	1½	5.00	8	6.67	.02	.02	.65	1270
Bananas	7	10.00	27	1.43	.01	.01	.18	370
Oranges	6	12.00	40	1.67	.01	. .	.13	250
Strawberries	7	8.75	47	1.43	.01	.01	.09	215
Sugar	6	. .	3	1.67	. .	. .	1.67	2920

[1] See foot-note, page 368.



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CHAPTER XL

PRINCIPLES OF COOKING

THE manner in which food is cooked and served has much to do with its digestibility and nutritive value.

The **objects of cooking** may be summed up as follows:

1. To make food more appetizing by improving the appearance and flavor. Almost all flesh foods and many vegetables are unpalatable in their raw state. The effect of a high temperature on them develops agreeable properties which are absent in the uncooked state, and increases the appetite for food.

2. To soften and otherwise change the structure of the food so that the digestive juices can act on it more easily. The heating of food enables it to become more easily masticated. In animal foods the muscular fibers lose much of the toughness shown in the raw state and are more readily divided, and the same is true of many vegetable foods.

3. To kill by heat disease germs or any injurious organisms which the food may contain. The heat acts as a preservative from putrefactive changes. At the same time it affords a safeguard to the individual. Both food and drink, in their raw state, may become carriers of disease into the system. Animal foods may contain injurious parasites. Vegetables and fruits may be contaminated with the eggs of various parasites found in the fertilizing material applied to promote growth. Exposure to heat for a short time is sufficient to render most foods safe in this respect.

Methods of Cooking.—Cooking is accomplished by several different processes. The varying of the methods of cooking prevents monotony, increases the appetite, and in different ways aids digestion:

1. Boiling.
2. Stewing.
3. Roasting.
4. Broiling or grilling.
5. Frying.
6. Braizing.
7. Baking.
8. Steaming.

Cooking of Flesh Foods.—All meats and fish lose weight in cooking. A part that is lost consists of salts, meat juices, and fats, but most of the loss is water.

Boiling.—If the purpose in boiling the meat is to prepare it for use as food, it should be plunged into boiling water and kept boiling for five minutes to coagulate the albumin on the outside, and form a coating that will prevent the escape of salts and soluble substances. There is no object in trying to increase the heat after the boiling-point has been reached. A temperature of 170° F. is sufficient to continue the cooking by this method. Rapid boiling tends to make the meat tough, dry, and less easily digested than if cooked by a slow, simmering process.

If the object in cooking the meat is to extract as much of its substance as possible for use as broth or soup, it should be placed in cold water and gradually heated. By this method the salts, juices, and soluble portions of the meat pass out into the water.

Broth is rendered still more nutritious if the meat is cut into very small pieces, put into cold water, and never actually brought to the boiling-point. If the temperature does not exceed 160° F., coagulation of the albumin in the muscle-fibers does not occur and more of the constituents are dissolved in the water. This method preserves the natural flavor.

Stewing prepares the meat to be eaten in the liquid in which it has been cooked. This slow method is specially suitable for coarse, cheap parts of meat. The usual plan is to add sliced vegetables and other substances. The meat is put on in a small amount of cold water, allowed to boil rapidly not longer than two minutes, and the cooking continued at a lower temperature. A temperature of about 160° F. is considered sufficient for simmering. From one and one-half to two hours is required and a longer time is desirable.

Roasting is cooking by the direct action of radiant heat. By this method the nutritive juices and properties of the meat are retained more completely than by boiling. The

meat to be cooked should be at first subjected to a strong heat and afterward cooked very slowly. The effect of this method is to form a surface crust, which prevents the escape of the soluble parts of the meat to a large degree.

Basting with the melted fat and water is important. It prevents too much of the surface becoming hardened, prevents scorching, distributes the heat more uniformly, and improves the flavor of the meat. Only a good quality of meat, and the tenderest parts, are suitable for cooking by roasting.

The time needed varies with the different kinds of meats. Pork requires longer roasting than beef. Thick pieces require longer than thin ones, and, lastly, the individual taste must be consulted as to whether the meat shall be underdone, medium, or well cooked. A general rule is to allow about fifteen minutes as the shortest time and thirty minutes as the longest time required for each pound of meat to be roasted. The same rule will apply for boiling. If moderate heat only is applied at first, the meat will be dry and stringy, and no amount of basting or attention afterward will hinder the result of this error in roasting.

Broiling or *grilling* is cooking by the direct action of fire close to the surface of the meat. The outer layer is quickly seared and a coating formed, which prevents the escape of the juices. Broiling requires a clear, very hot fire high in the grate, preferably a coal fire. The meat needs to be turned very frequently. A double gridiron is best for this purpose. If this is not available, a knife should be used for turning instead of a fork, which will puncture the meat and let the juice escape. Frequent turning has much to do with successful broiling. If this is not done, the juices will be driven upward to the surface and lost. Unnecessary drying of the surface is prevented by smearing with butter or fat before cooking. This method is regarded as probably the most wholesome of all methods of cooking meat, but it requires experience and careful watching for signs if a successful result is to

follow. It is only suitable for thin pieces of meat, such as steaks and chops, and only meat of a good quality should be prepared in this way. One of the signs that broiled meat is cooked is a lessening of the puffiness which appears as the result of the first contact with the heat. Broiled meat should be moist, red, and very juicy. Overcooking destroys the flavor.

Poultry, small birds, and some kinds of fish may be successfully prepared by broiling. As birds, as a rule, have but little natural fat, they are generally encased in stiff paper, thoroughly greased, before being exposed to the heat, to prevent drying. This method has the advantage of being rapid and convenient. The principle of cooking is similar to roasting, but a far larger surface is exposed at once to the direct action of a strong heat.

Braizing is a combination of roasting and steaming. Meat cooked in this way is popularly termed "pot-roast." A regular braizing pot consists of a deep pot or pan to hold the meat and a shallower pan for the tight lid, into which hot charcoal is placed. A small amount of water and, usually, some savory vegetables or herbs are placed in the braizing pot and the meat laid on them. Only sufficient water is used to keep the meat from burning and to generate the steam. The cooking should proceed very slowly, and the meat should be turned several times. Usually this method is accomplished by using a common heavy iron pot and a tight cover. If the meat is not sufficiently browned, it can be put for a few minutes in a hot oven at the close of the cooking. This manner of cooking is suitable for quite large solid pieces of meat. The cheaper cuts of beef are often prepared in this way to be eaten cold. Flavor and moisture are imparted to inferior pieces of meat by braizing.

Frying consists in exposing food to the action of fat at a very high temperature. The boiling-point of fat is much higher than of water, and a temperature of about 380° F. is required. Two methods of frying, the wet and the dry, are practised. Wet frying requires a deep vessel and

enough fat or oil to completely cover the article to be cooked in it. The heat of the fat before the food is put in is very important. It should be hot enough for a piece of white bread put in it quickly to turn to a golden color. Usually when this degree of heat is reached, a bluish vapor will rise from the fat. Most foods to be cooked in this way require to be smeared with some substance that will quickly form a crust when heated; usually egg or butter are used. This coating or crust prevents the fat penetrating into the food, and also the flavor of the food escaping into the fat. This method of frying is much to be preferred to the dry method, known as "sauteing." In the dry method less fat is needed, but the flavors of the food escape and the fat permeates the substance fried, making it very difficult of digestion for any but persons with a very strong, robust stomach. It should never be used in cooking for invalids or any individual with poor digestive powers. An exception to this rule is bacon, which is fried in its own fat. It is stated by food experts that the art of frying is less understood than any other method of cooking. As generally conducted, frying is a kind of accidental combination of broiling and toasting. The result is that fried food, as it is usually cooked, is notoriously indigestible.

Fish may be cooked by boiling, grilling, or frying. Boiled fish are most easily digested. The boiling should be continued till the meat can be readily separated from the bones. A little salt in the water improves the flavor and makes the meat firmer.

It should always be remembered that extreme heat tends to harden the lean portions of meat and weakens or impairs the flavor. Proper cooking develops the agreeable flavor, softens the tissues, and makes the meat more tender.

SOUPS

Soups may be divided into four classes: Broths, thick soups, purées, and clear soups. The base of a great many soups is stock.

Stock may be made from meat or bones with water. Vegetables may be added for flavoring if it seems desirable, but unless the flavor of a special vegetable is desired, the common vegetables such as onion, carrot, turnip, parsley, etc., may be used in equal proportions. Dried herbs used for flavoring should be tied in muslin.

If dark soups are desired, the meat may be seared on a hot pan before boiling, but this is rarely necessary for invalids.

Salt added to the water helps to extract the juices from the meat.

Second stock is often made from the materials strained out of the first, with perhaps bones of cooked meats and gravy added.

Veal produces a whitish stock; beef, a stock more or less brown. The chief secret of good stock making is slow cooking.

Fish stock is sometimes made from white fish, the bones, skin, etc., being used with savory vegetables for seasoning. More water is used in making fish stock, as the flavor is stronger.

A pint of water for each pound of meat or bone, and one additional pint for evaporation, is a good rule for making stock.

Broth or *bouillon* is unclarified stock, in which vegetables or some special substance have been used for flavoring. Bouillon is usually of a dark color.

Thick soup is stock thickened by the addition of some starchy substance or eggs.

Purées are thick vegetable soups. The vegetables are pressed through a sieve and mixed with the soup. Purées may or may not be made from meat stock. Very frequently milk is used instead of stock.

Clear soup or *consommé* is stock made from good meat, usually with some special flavor, and freed from everything that would make it cloudy. In all soup making, skimming away the froth or scum that arises is an important point.

COOKING OF STARCHY FOODS AND VEGETABLES

The effect of heat on vegetable substances is similar to that produced on flesh foods. The structures are softened and made ready for mastication and digestion.

Starch Granules.—The principal nutritive element in vegetable substances is starch. The microscopic starch grains are contained in very minute cells. These cell walls are thick and digestive juices have little effect on them. The chief effect of heat is to rupture the cell wall or outer envelope, in which are the starch granules, leaving the starch in a condition to be easily and promptly acted on by the saliva, and other starch-digesting fluids. A portion of the starch is converted into sugar by heat. On the albuminous substances of vegetables heat has the same effect as on animal tissues. In various ways it produces desirable flavors in food exposed to it.

In *making bread* and other foods in which flour is the chief ingredient, the aim is to make a firm, porous substance which can be readily masticated and more easily permeated with the digestive juices than the raw materials could be. The flour is made porous by the addition of water, some form of leaven, and a certain degree of heat. In a short time the mass begins to swell or "rise," and while active fermentation is going on the sponge is kneaded and again allowed to rise. If sufficient fermentation is not allowed, a heavy loaf is the result. If fermentation proceeds too far before being checked by extreme heat, a different form of fermentation starts, which is acid in character, and the result is sour bread.

Yeast is a vegetable organism, which, like the bacteria, lives and grows when provided with suitable nourishment, warmth, and moisture.

Extreme heat kills the yeast when fermentation has proceeded far enough.

Baking powder when mixed into flour and water causes the mass to become porous by producing carbonic acid gas. Aërated bread is made by forcing carbonic acid gas into the dough under pressure.

Steaming of vegetables prevents loss of various salts, and is a desirable method of cooking potatoes, rice, and a few other vegetables. The steaming of doughy substances renders them stringy, tough, and less easily digested than baking. It is, therefore, not a desirable method of cooking such foods for invalids.

CHAPTER XLI

MILK

The percentage composition of good cows' milk is thus given by Parkes:

Specific Gravity, 1029 and Over

Water	86.8
Protein	4.0
Fats	3.7
Carbohydrates	4.8
Salts	0.7

Milk has been termed a perfect or complete food because it contains all the elements needed for the nourishment of the body. It is a perfect food for infants or the young of milk-producing animals, but it does not fully meet the conditions of a perfect food outlined in a previous chapter. There are three reasons why it cannot be considered a perfect food for healthy adults, though it has special value as a food for invalids, and life can be supported for a considerable time on milk without other foods:

1. The proportion of water is so large that large quantities would have to be consumed per day in order to obtain the necessary nutrients.

2. The protein is present in rather large quantities as compared with the fats and carbohydrates.

3. The digestive functions require that the food shall have a certain bulk other than water.[1]

[1] Bulletin 74, United States Department of Agriculture.

Milk as a Food for Invalids.—There are several reasons why milk is considered of special value in sickness:

It is easily digested and capable of almost complete absorption.

It does not irritate the alimentary tract and leaves no coarse residue in the intestine.

It is more easily measured and controlled, both as to quantity and quality, than most other foods.

Added to these reasons are the facts that it is comparatively cheap and easily procured.

Nutritive Value.—It is said that 1 quart of milk contains about the same amount of nutritive material as $\frac{3}{4}$ pound of beef or 6 ounces of bread, or about 4 ounces. There is, however, considerable variation in the nutritive material in different specimens of milk, due to the food supplied to the cow, to the age, and other conditions.

The habit of excessive drinking of milk by active persons in good health who are taking solid food is condemned by the best authorities as conducive to constipation, dyspepsia, and torpidity of the liver. As a food for the young and the aged, when solid food is not well digested, it has a special value. The reason why milk so frequently disagrees when taken as an exclusive diet is said to be that it contains too much of the nitrogenous element as compared with the carbohydrates.

Bacteria in Milk.—The souring of milk is due to the presence in it of bacteria, which act on the sugar, changing it into lactic acid. The casein becomes coagulated by the acid produced. Sour milk is not necessarily unwholesome, but it should always be remembered that milk is an excellent food for both good and bad germs. It has been found that disease germs that would soon die in water will grow and multiply rapidly in milk. This has led to rigid precautions on the part of public health authorities regarding the care of milk, since in careless transportation and handling, germs of all kinds are readily absorbed and transmitted.

Skimmed milk, or milk from which the cream has been taken away, is still a valuable food, since only the fat has been removed. It still contains the tissue-building ingredients.

Cream is chiefly valuable for its heat-giving properties, and the same is true of **butter**. These are the most agreeable and easily digested of all animal fats.

Buttermilk furnishes more nutriment than most other beverages, and is practically equal in food value to skimmed milk. "An ordinary glass of buttermilk is said to contain as much nourishment as ½ pint of oysters, or 2 ounces of bread, or a good-sized potato." It is a much more agreeable food to many people than either whole or skimmed milk, and is largely used in cases of feeble digestion because of the ease with which it is digested.

Curds and Whey.—When an acid or rennet is added to milk, the casein, the solid portion and the chief nitrogenous element of milk, coagulates and forms the curd. The fluid from which it separates is the whey. The curd, which is frequently used as food in the form of "cottage cheese," is rich in tissue-building elements and easily digested as compared with other solid foods.

The whey contains little nutritive material, but is a useful diuretic beverage. There are special methods of preparing whey, especially for infants and invalids, by which a considerable portion of the nutritive elements are retained.

Cheese contains the casein or curd of the milk with a certain proportion of the fat. It contains, weight for weight, twice as much nutriment as meat. The special flavors produced are the result of different forms of bacteria. Cheese is usually regarded as difficult to digest, and if given to invalids should be given in small quantities, rather as a condiment than as a food.

Milk-sugar lacks the sweetness of other sugar, and is much less liable to cause disagreeable fermentation in the stomach or intestines. It resembles powdered sugar in appearance. It is considered particularly suitable

for infants, and is extensively used in the manufacture of pills.

Effects of Heat on Milk.—Milk is sterilized by bringing it to the boiling-point (212° F.).

Pasteurization of milk is accomplished by exposing it to heat for twenty minutes at 167° F. It is said to be more easily digested than milk which has been sterilized, but there is much conflicting testimony offered regarding this matter. A great many authorities claim that not only is sterilized milk more difficult to digest than raw milk, but that certain of its nutritive elements are destroyed. Heat has the effect of destroying the injurious germs present, and this seems to be quite sufficiently accomplished by pasteurization.

Modified milk is a term applied to cows' milk which has been modified or changed in character and adapted for the use of infants and invalids. The particular methods used in preparing milk for infants will be discussed in connection with the care of infants in a succeeding volume of studies. The methods of altering milk for the use of invalids must be, to a large extent, governed by the tastes, and general condition of the individuals. Much care and good judgment must be exercised by the nurse in administering milk, especially when it forms the sole or the chief article of diet.

Digestion of Milk.—Milk, though it is a fluid outside the body, is quickly curdled and turned into a solid by the action of pepsin and the acid fluids of the stomach. When milk is taken without other foods, the casein is liable to gather in hard lumps or curds which are difficult to digest. Human milk, when taken into the stomach of an infant, is not precipitated in such large lumps, but is more flaky, and, therefore, more easily acted on by the digestive fluids. It is said that the boiling of cows' milk tends to make the curds formed from it by the stomach juices more flaky in character. Many authorities state that lime tends to prevent the casein forming in hard indigestible lumps by neutralizing the acids, and also by

its own property of retarding coagulation. For this reason lime-water is often added to the milk fed to infants and invalids who have feeble digestive powers.

The Administration of Milk.—The proper management of a milk-diet calls for skill and intelligence. It is not sufficient simply to carry a stipulated amount of milk to a patient and let him swallow it as rapidly as possible, as he would a nauseous dose of medicine. There is no better way to make sure that it will disagree. One of the first lessons the nurse should teach her patient is how to drink milk. It should be sipped slowly, that it may become thoroughly mingled with the saliva. In fact, it should always be remembered that milk is a food which should be eaten rather than drunk. When thus used it is not likely to form into tough, indigestible masses in the stomach, that cause distress, are rejected, or pass through the bowel undigested.

In certain fevers or other acute ailments, when the patient objects to milk and there is a probability of the milk or fluid diet having to be long continued, it is well to start by giving but 1 ounce or even ½ ounce at a time, giving it either ice cold or very hot, and repeating every fifteen minutes for a few hours, until the patient learns that it does not disagree with him. Then the quantity may be increased.

Whenever there is a tendency for milk to disagree, other substances, such as chicken broth or whisky, should not be combined. Milk should never be given at or near the same time with medicines.

One of the very best ways of administering milk is in the form of junket, flavored with some substance which the patient likes. Junket is really milk which is partly digested by the action of rennet. Very often a patient may be beguiled in this way into taking milk, because it looks different and can be eaten with a spoon. It is an excellent method of varying the monotony of a purely milk-diet.

A very smooth, bland, easily digested custard may be

made with milk and gelatin, suitably flavored, which makes an agreeable change in a purely milk-diet.

Where there is an objection to animal broths, a very agreeable, nourishing drink may be made of equal parts of strong chicken broth and milk, heated to a boiling-point.

Another combination that appeals to lovers of coffee is the addition of a tablespoonful of strong black coffee to 4 or 5 ounces of milk, served hot. Other patients may prefer the tea or cocoa flavor, and, at other times, vegetable flavors, such as celery or tomato, may be used. Where starchy substances are not forbidden, milk may be given with strained cereal gruels, both for variety and to improve its digestibility. Unless the condition of the stomach forbids, it will generally be found that milk is less likely to disagree if a cracker, small piece of bread, or some starchy substance is given with it. This is particularly true where children are concerned.

Diluting milk with very hot or very cold water makes it more easily digested in many cases, and Vichy or similar waters are often used.

Barley-water is recommended frequently in diluting milk in cases of diarrhea, and oatmeal-water where constipation exists. It is well to remember that where a tendency to constipation exists, the use of lime-water exaggerates the difficulty, while it is a decided help in dealing with diarrhea or nausea.

Predigestion of milk is accomplished by the addition of pepsin or pancreatin to the milk before it enters the body. By this means the alimentary system is relieved of part of its work, and a portion of the digestion completed before the milk is taken.

A government bulletin [1] gives the following two tables, which show that a meal of bread and skimmed milk, costing 4 cents, contained as much nutritive material as a 15-cent lunch containing nine different food materials:

[1] Bulletin, No. 74.

Composition and Cost of a Lunch or Meal of Bread and Skimmed Milk

Food materials.	Amount.	Estimated cost.	Protein.	Fuel value.
		Cents.	*Pound.*	*Calories.*
Bread	10 oz.	3	0.06	755
Skimmed milk	1 pt.	1	.03	170
Total	. . .	4	.09	925

Estimated Cost and Nutrients of a Restaurant Lunch

Food materials.	Amount.	Estimated cost.	Protein.	Fuel value.
	Ounces.	*Cents.*	*Pound.*	*Calories.*
Soup	8	. . . .	0.01	75
Beef	2	. . . .	.02	275
Potatoes	2	. . . .	. . .	100
Turnips	1	. . . .	. . .	15
Bread	4	. . . .	.02	300
Butter	½	. . . .	. . .	100
Coffee:				
Milk	1	. . . .	. . .	20
Sugar	½	. . . .	. . .	55
Total	. . .	15 to 20	.05	940

CHAPTER XLII

EGGS AND FLESH FOODS

EGGS

Eggs supply a highly nutritious food in concentrated form. They are like milk, in that they contain all the elements found in the animal body. Out of the egg the entire structure of the bird—bones, muscle, nerves, etc., even feathers, in some cases—is developed. In this development the shell is included, since it contains elements necessary to the life of the bird.

Hens' eggs are chiefly used as food, though occasionally those of other domestic fowls are eaten. The ingredients are practically the same, but the quality and flavor are

peculiar to different birds. The flavor is also, to some extent, dependent on the food of the hen. The shell of the egg is not impervious. It will absorb strong odors, and bacteria may penetrate the shell and effect decomposition. The shell is chiefly composed of carbonate of lime.

The *yolk* contains about 15 per cent. of proteid matter, 33 per cent. of fat, with water and other mineral elements. The white contains slightly less proteid and almost no fat. The yolk contains more nutriment than the white, which is mostly albumin in solution.

Eggs form an easily digested food if taken raw or very lightly cooked, and are, therefore, especially suitable for invalids. In the intestines, if absorption of eggs is long delayed, a peculiar form of decomposition results, due chiefly to the yolk of the egg. This may cause disorder of the stomach and intestines. It is exceedingly important in giving eggs to patients in whom those organs are deranged to have them "strictly fresh" if possible. Owing to idiosyncrasy some persons are unable to take eggs in any form, or in the smallest amount, without the development of toxic symptoms, illustrating the undoubted truth that "one man's meat is another's poison." Different individuals are quite differently constituted regarding the chemical changes which foods taken into the system undergo and in the effects produced by foods. There is probably no other common article of food about which invalids are as capricious regarding cooking as eggs. The albumen coagulates at a temperature of 158° F. Rapid boiling renders it tough, and a little carelessness about cooking and serving an egg makes the difference between easy and difficult digestion, between a palatable and an insipid, disagreeable article.

When eggs are beaten to a stiff froth for cooking, the albumen encloses air in bubbles, which expand and stiffen when exposed to heat and mixed with dough or batter, making the food light and spongy. This quality of frothiness is lost when eggs are kept for a long time before using.

A medical authority on dietetics states that there are five hundred different ways of cooking eggs, and every nurse ought to be familiar with at least a dozen different methods of preparing eggs for the use of invalids.

MEATS

The value of meat as an article of diet depends on the two classes of nutritive elements, protein and fats.

Advantages of Meats as Food.—The fact that animal foods contain precisely the same elements as the human body is considered a strong point in favor of their use.

"They are rich in nitrogenous elements and fat.

"They are more easily and completely digested and assimilated than vegetable foods.

"They are easily cooked and improve in flavor during the process.

"They contain important salts, chiefly potassium and iron."

Disadvantages of Meat.—While animal foods seem exceedingly well adapted for maintaining the body and building new tissue, they are not valuable for producing force or energy. Their disadvantage is in the absence of starch. This disadvantage is less where there is a considerable proportion of fat with the meat.

Composition and Digestibility of Meat.—Digestibility is influenced by many conditions, including the age of the animal before slaughtering, the sex, the state of nutrition, the part of the body used, etc. Fat meat is more difficult to digest than lean. Meat from young animals contains more gelatin, but less nutritive elements, on the whole, and a larger relative proportion of bone.

Meat consists of lean or muscular tissue, gristle, fatty tissue, blood-vessels, nerves, and bones. The amount of each of these substances varies with different cuts of meat, and with other conditions.

Beef is one of the most nutritious of all animal foods, and, when properly cooked, is fairly easily digested.

Quality.—The first quality of meat includes rump, sirloin, and fore-ribs.

The second quality includes a portion of shoulder, buttock, middle rib, etc.

The third quality includes the flank, shoulder, and brisket.

The fourth quality includes cheek, neck, and shin.

Veal has the reputation of being less easily digested than beef or mutton. It contains more gelatin than beef, but is not regarded as having any special value for the use of the sick.

Mutton is richer in fat than beef, is less easily digested, and contains equal nutritive value.

Pork is a tender-fibered meat, but because of the high percentage of fat is considered a highly indigestible food.

Ham may contain little fat, and is, therefore, not open to this objection.

Bacon is said to be less likely to disagree with the stomach than the other fat of pork, and, when combined with eggs, beans, and other articles containing much nitrogen, helps to give a proper balance to the dietary.

Sweetbread is a meat delicacy that is considered a useful food for convalescents. There are two kinds, one consisting of the pancreas of the calf, frequently called "stomach sweetbread," and, the other of the thymus gland of the same animal, distinguished by the term "neck" or "throat" sweetbread. The latter is considered somewhat more easily digested than the former, but both are easily digested meats.

Liver.—The liver of the pig, calf, and lamb are used as human food. The meat is rich and close of texture, and suitable only for persons with good digestive powers. The same is true of **kidneys** and **heart.**

Tripe consists of the paunch or third stomach of the ox. It is considered to be comparatively easy of digestion when well cooked, but contains too much fat to make it a desirable food for invalids.

Rennet is a preparation obtained from the stomach of the calf. It is not used separately as a food, but is used in milk to a considerable extent. It causes milk to curdle

and partially solidify. It is used in preparing junket, and sometimes, whey.

Brains are easily digested, but have little nutritive value. Because of the amount of fat they are considered unsuitable as a food for the sick.

The **thyroid gland** is sometimes cooked and eaten as food in cases of myxedema and chronic skin disease. As a rule, it is given dried in moderate doses as a medicine rather than as a food.

Gelatin is a by-product of the slaughter-house obtained from bones, ligaments, and other connective tissue of animals. Before being purified it is known as glue. It enters considerably into the composition of soup where much bone is used, and is extensively used in making jellies and other forms of light diet for invalids. It has also varied uses in the preparation of medicines.

Gelatin does not build up tissue nor produce force. Its chief use is as a preventive of waste of tissue. For this reason it has considerable value as a food in fevers that are accompanied by much loss of flesh. When combined with other foods, gelatin promotes nutrition and is easily digested and absorbed.

Calf's foot and *head jellies* are easily prepared forms of gelatinous foods, and, when properly flavored, are useful in the invalid's dietary. These need several hours' boiling. Though the amount of real nourishment in such jellies is small, and they should not be used instead of albuminous foods, yet, because they do save waste of tissue, they hold a place of some importance among foods for invalids.

Poultry and Game.—Chicken ranks high among easily digested foods. The dark meat is rather more difficult to digest than the white. When used for broths and jelly an old fowl, not too fat, is preferable. When the meat of the chicken is the substance required, a fowl from one to two years old is desirable. The proportion of bone to meat in chickens under that age makes them an expensive article of diet.

The flesh of game has slightly less fat than that of

poultry and a finer flavor. Snipe, quail, and woodcock are too rich foods for the average invalid. Pheasant, partridge, and young pigeons are tender, delicate in flavor, and easy of digestion.

Turkey, especially the white meat, is a meat almost as easily digested as chicken.

Ducks and *geese* contain much fat and, unless quite young, are somewhat difficult of digestion.

FISH

The term fish includes, besides fish proper, other water animals, such as oysters, clams, crabs, lobsters, etc.

Fish helps to supply the nitrogenous element needed in the diet and to meet the demand for variety. The different varieties differ greatly in nutritive value, in flavor, and also in digestibility, owing largely to the proportion of fat. Salmon is considered richer in nutritive elements than most other varieties of fish, and the oily or coarser grained species more nutritious than the white or finer grained, although the latter have the more delicate flavor and are easier of digestion. A government bulletin divides fish into three classes, according to the proportion of fat: The first class (fish containing over 5 per cent. of fat) includes salmon, shad, herring, and Spanish mackerel. The second class (fish containing between 2 and 5 per cent. of fat) includes white fish, mackerel, and halibut. The third class (fish containing 2 per cent. of fat) includes smelt, black bass, blue fish, white perch, brook trout, yellow perch, pike, pickerel, sea bass, cod, and haddock. In general, it may be said that all fish having white meat deserve a place in the invalid's diet.

Shell fish resemble meat and other fish in general food elements.

Oysters are probably the most important of the shell fish, judging by the amount used. Taking cost and nutritive value into consideration, they are a highly expensive food. Authorities state that 1 quart of oysters contains only about the same amount of nutritive substance as 1 quart of milk. Oyster stew or oyster broth

owes its nourishing qualities more to the milk used in its preparation than to the oysters it contains. In regard to digestibility, raw oysters rank first or almost first among flesh foods.

Oysters which have been "floated" in brackish water near the mouth of a stream are frequently infected by disease germs carried into the stream from the sewage. Numerous cases of typhoid fever have been traced to this cause.

Clams are useful in the invalid's diet chiefly for broths. Plain clam broth is especially valuable in cases of vomiting and nausea, and will often be retained when all other food is rejected. It has slight nutritive value and is mildly stimulating and laxative.

Occasionally, the shell fish produce an eruption of the skin, such as hives or eczema.

Lobsters, crabs, and *shrimps* have been termed "scavengers of the sea." In spite of this, the meat is said to be wholesome, but none of these are suitable foods for invalids, however prepared.

Phosphorus and Brain Power.—The general belief has prevailed that "phosphorus has a special relation to brain activity. Because fish was supposed to contain much phosphorus it was commonly spoken of as "brain food." It has never been proved that fish is any richer in phosphorus than meat, eggs, milk, or certain grains, or that phosphorus was more essential to brain activity than other elements.

Frog's Legs.—In this country, as a rule, only the hind legs of frogs are eaten. They are considered rather expensive delicacies when the amount of nutriment contained is computed. In some places the meat on other parts of the frog is eaten, and the frog as an article of diet seems to be growing in favor among the people who can afford luxuries.

Food Value of Broths.—How much real nutriment is contained in meat soups and broths is a question that has been much discussed. The value of broth is small compared to that of the meat fiber, as boiling extracts very little

of the protein element. Broth contains the gelatin and salts which give flavor to the water. As frequently made, broths or soups contain little real nutriment. One authority states that the value of broth lies in the extractives that give it flavor, the small amount of gelatin it contains, its power to stimulate the flow of the gastric juices, and so whet the appetite rather than satisfy it.

The meat left after making the soups still contains a large portion of its nutritive elements, and, when combined with vegetables or other substances which can be used to improve its flavor, it is a useful article of diet.

The proper cooking and serving of either meat or fish have much to do with their food value to the patient. It matters little how much the nurse may know as to the exact elements contained in the meat, if she does not know how, or does not take the pains, to cook it so as to conserve its food values and make it agreeable to the taste of the invalid. Half-cold meats, gravy, or broth are quite sufficient to spoil a whole meal for an invalid.

Balanced Dietaries.—"The principal classes of food materials may be roughly grouped as follows as regards the proportion of protein to fuel value, beginning with those which have the largest proportion of protein and ending with those which contain little or no protein:

"Foods containing a large amountof protein as compared with the fuel value.	Fish; veal; lean beef, such as shank, shoulder, canned or corned, round, neck, and chuck; skimmed milk.
"Foods containing a medium amount of protein.	Fowl; eggs; mutton, leg and shoulder; beef, fatter cuts, such as rib, loin, rump, flank, and brisket; whole milk; beans and peas; mutton, chuck and loin; cheese; lean pork; oatmeal and other breakfast foods; flour; bread, etc.
"Foods containing little or no protein.	Vegetables and fruit; fat pork; rice; tapioca; starch; butter and other fats and oils; sugar, sirups.

"In planning a well-balanced diet the following points must be considered:

"1. The use of any considerable amount of fat meat or starchy food should be offset by the use of some material rich in protein. Bean soup furnishes a considerable amount of protein, while bouillon, consommé, or tomato soup are practically useless as sources of nutriment. Skimmed milk also furnishes protein, with but very little accompanying fats and carbohydrates to increase the fuel value.

"2. The use of lean meats or fish for all three meals would require the use of such foods as rice, tapioca, or cornstarch pudding, considerable quantities of sugar and butter, and more vegetables, in order to furnish sufficient fuel value.

"3. Since flour, sugar, and butter or lard enter very largely into pastries and desserts, the larger the quantities of these dishes that are consumed, the larger does the fuel value tend to become, as compared with the protein." [1]

CUTS OF MEAT[2]

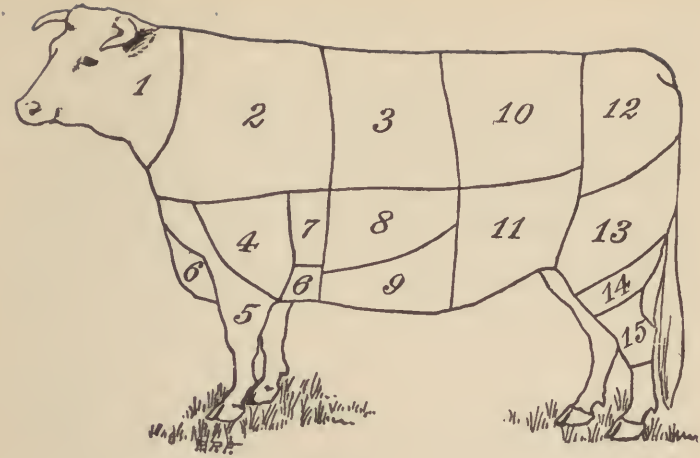
The methods of cutting sides of beef, veal, mutton, and pork into parts, and the terms used for the different "cuts," as these parts are commonly called, vary in different localities. The diagrams show the positions of the different cuts, both in the live animal and in the dressed carcass, as found in the markets. The lines of division between the different cuts will vary slightly, according to the usage of the local market, even where the general method of cutting is as here indicated. The names of the same cuts likewise vary in different parts of the country.

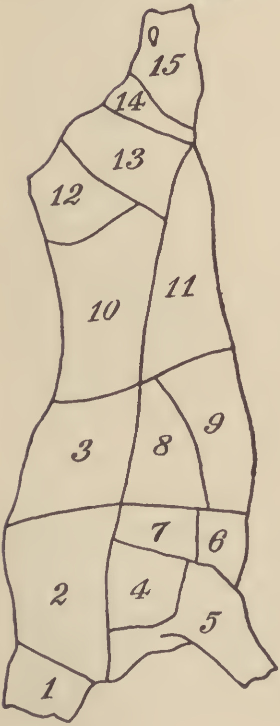
Cuts of Beef

The general method of cutting up a side of beef is illustrated in Fig. 112, which shows the relative position of the cuts in the animal and in a dressed side. The neck piece is frequently cut so as to include more of the chuck than

[1] Bulletin, No. 74.

[2] This section relating to cuts of meat and the accompanying diagrams are taken from Government Bulletin, No. 34.





1. Neck.
2. Chuck.
3. Ribs.
4. Shoulder clod.
5. Fore shank.
6. Brisket.
7. Cross-ribs.
8. Plate.
9. Navel.
10. Loin.
11. Flank.
12. Rump.
13. Round.
14. Second cut round.
15. Hind shank.

FIG. 112.—Diagrams of cuts of beef.

is represented by the diagrams. The shoulder clod is usually cut without bone, while the shoulder (not indicated in diagram) would include more or less of the shoulder-blade and of the upper end of the fore-flank. Shoulder steak is cut from the chuck. In many localities the plate is made to include all the parts of the forequarter, designated on the diagrams as brisket, cross-ribs, plate, and navel, and different portions of the plate, as thus cut, are spoken of as the "brisket end of plate" and "navel end of plate." This part of the animal is largely used for corning. The ribs are frequently divided into first, second, and third cuts, the latter lying nearest the chuck and being slightly less desirable than the former. The chuck is sometimes divided in a similar manner, the third cut of the chuck being nearest the neck. The names applied to different portions of the loin vary considerably in different localities. The part nearest the ribs is frequently called "small end of loin" or "short steak." The other end of the loin is called "hip sirloin" or "sirloin." Between the short and the sirloin is a portion quite generally called the "tenderloin," for the reason that the real tenderloin, the very tender strip of meat lying inside the loin, is found most fully developed in this cut. "Porterhouse steak" is a term most frequently applied to either the short steak or the tenderloin. It is not uncommon to find the flank cut so as to include more of the loin than is indicated in the figures, in which case the upper portion is called "flank steak." The larger part of the flank is, however, very frequently corned, as is also the case with the rump. In some markets the rump is cut so as to include a portion of the loin, which is then sold as "rump steak." The portion of the round on the inside of the leg is regarded as more tender than that on the outside, and is frequently preferred to the latter. As the leg lies upon the butcher's table this inside of the round is usually on the upper or top side, and is, therefore, called "top round." Occasionally the plate is called the "rattle."

Cuts of Veal

The method of cutting up a side of veal differs considerably from that employed with beef. This is illustrated by Fig. 113, which shows the relative position of the cuts in the animal and in a dressed side. The chuck is much smaller in proportion, and frequently no distinction is made between the chuck and the neck. The chuck is often cut so as to include a considerable of the portion

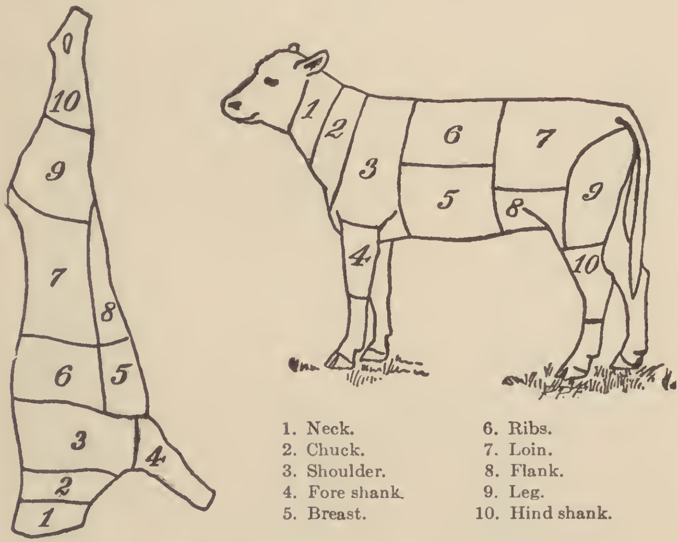


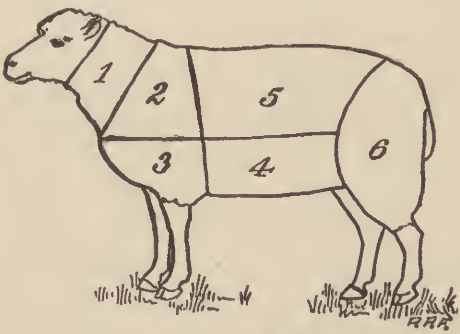
Fig. 113.—Diagrams of cuts of veal.

here designated as shoulder, following more nearly the method adopted for subdividing beef. The shoulder of veal as here indicated includes, besides the portion corresponding to the shoulder in beef, the larger part of what is here classed as chuck in the adult animal. The under part of the forequarter, corresponding to the plate in the beef, is often designated as breast in the veal. The part of the veal corresponding to the rump of beef is here in-

cluded with the loin, but is often cut to form part of the leg. In many localities the fore and hind shanks of veal are called the "knuckles."

Cuts of Lamb and Mutton

Figure 114 shows the relative position of the cuts in a dressed side of mutton or lamb and in a live animal. The cuts in a side of a lamb and mutton number six, three in each quarter. The chuck includes the ribs as far as the end of the shoulder-blades, beyond which comes the loin. The flank is made to include all the under side of the animal. Some butchers, however, make a larger number of cuts in the forequarter, including a portion of the cuts marked "loin" and "chuck" in Fig. 114, to make a cut designated as



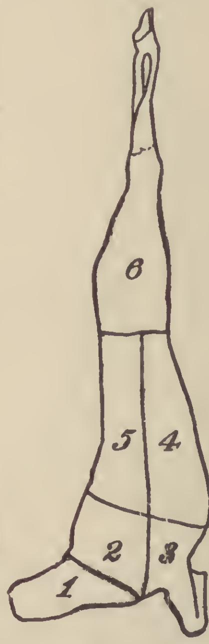


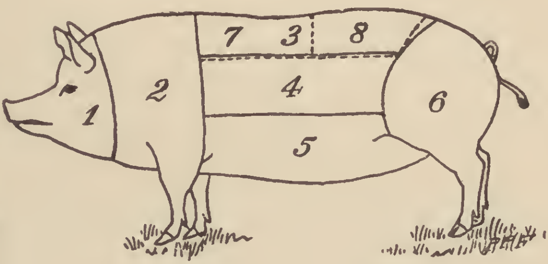
Fig. 114.—Diagrams of cuts of lamb and mutton.

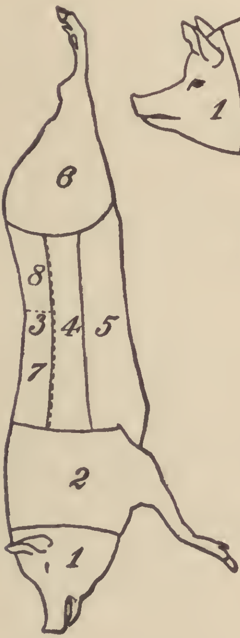
"rib," and a portion of the "flank" and "shoulder" to make a cut designated as "brisket." The term "chops" is ordinarily used to designate portions of either the loin, ribs, chuck or shoulder, which are either cut or

"chopped" by the butcher into pieces suitable for frying or broiling. The chuck and ribs are sometimes called the "rack."

Cuts of Pork

The method of cutting up a side of pork differs considerably from that employed with other meats. A large portion of the carcass of a dressed pig consists of almost clear fat. This furnishes the cuts which are used for "salt pork"





1. Head.
2. Shoulder.
3. Back.
4. Middle cut.
5. Belly.
6. Ham.
7. Ribs.
8. Loin.

Fig. 115.—Diagrams of cuts of pork

and bacon. Figure 115 illustrates a common method of cutting up pork, showing the relative position of the cuts in the animal and in the dressed side. The cut designated as "back cut" is almost clear fat and is used for salting and pickling. The "middle cut" is the portion quite generally used for bacon and for "lean ends" salt pork. The belly is salted or pickled or may be made into sausages.

Beneath the "back cut" are the ribs and loin, from which are obtained "spareribs," "chops," and roasting pieces, here designated by dotted lines. The hams and shoulders are more frequently cured, but are also sold

fresh as "pork steak." The tenderloin proper is a comparatively lean and very small strip of meat lying under the bones of the loin and usually weighing a fraction of a pound. Some fat is usually trimmed off from the hams and shoulders, which is called "ham and shoulder fat," and is often used for sausages, etc. What is called "leaf lard," at least in some localities, comes from the inside of the back. It is the kidney fat.

CHAPTER XLIII

VEGETABLE FOODS

CEREALS

Of all vegetable foods, cereals rank first in importance. The **cereals** most frequently used as food are wheat, rice, corn, barley, oats, and buckwheat. Of these, wheat is the most important. It has been found that, with the exception of milk, bread made from wheat will support life and strength better than any other single food.

Bread.—All breads are nutritious foods, but experiments have shown that white bread yields the largest percentage of digestible nutritive materials, whole-wheat bread stands next, and Graham bread last. The coarser flours, containing a certain amount of bran, have a slightly laxative effect and are useful where there exists a tendency to constipation.

It is a well-known fact that the food value of bread does not depend wholly on the ingredients it contains. It must be light to be well digested, so that the nutriment can be appropriated. Wheat contains tissue-building elements, starch, sugar, and is rich in phosphates. It lacks fats and salts needed to make it a complete food. Badly made bread is a common cause of dyspepsia.

Stale bread differs from fresh bread in that the water has shifted from the interior of the loaf to the crust. In

fresh bread the crust is crisp and dry and the interior is moist and easily compressed into lumps. This is probably the reason why fresh bread seems to offer more resistance to the digestive juices than stale bread. As a rule, fresh bread is likely to be less thoroughly divided and made ready for digestion than stale bread, which easily separates into crumbs.

Toast increases the digestibility of bread if the toast is properly made. The slices should be thin, so that the heat may penetrate throughout and render it crispy. If the outer layers only are scorched, the inner part of the slice is rendered soggy and less easily digested than before it was toasted.

In the cooking of bread the starch in the crust, under the influence of the extreme heat, is changed into dextrin, and when bread is properly toasted, a similar process takes place, which leaves less work for the digestive organs to do. All starch must be converted into dextrin or sugar before it can be assimilated.

Macaroni is made from hard Italian wheats, rich in gluten, and from which starch has been partly removed. Sir Henry Thompson, an English authority on foods, says of it: "Weight for weight, macaroni may be regarded as not less valuable for flesh-making purposes in the animal economy than beef or mutton. Most people can digest it more easily and rapidly than meat. It offers, therefore, an admirable substitute for meat, particularly for lunch or midday meals. Cooked alone with water it is somewhat tasteless, but when combined with cheese or stock it makes an agreeable food." It needs very thorough boiling and should be given only to persons with good digestive powers.

Breakfast foods have become an exceedingly important commercial product in the United States and Canada, and extravagant claims are made as to the nutritive value of different brands. A great many people have placed reliance on such statements as these accompanying the package: "One package (1 pound) is equal to 4 pounds

of oatmeal in nutriment." "This food is particularly recommended for nursing mothers, to increase the quantity and quality of the breast milk." "This is a condensed food, about 4 heaping teaspoonfuls being sufficient for the meal." "One pound of this food is equal to 10 pounds of meat, wheat, oats," etc.

Most of these foods are manufactured from wheat, corn, or oats, and as a fountain cannot rise higher than its source, it is impossible for these foods to contain more nutriment than the original grain.

Nearly all breakfast foods contain considerable fiber and mineral matter, besides starch and some gluten. The fiber helps to excite peristalsis and most of these foods are wholesome for the average person.

In actual nutritive value oatmeal (rolled oats) stands at the head of the list. It contains more protein than other breakfast foods, besides starch and a certain proportion of fat.

All cereal foods need to be very thoroughly cooked. A common reason why cereal foods disagree with certain individuals is insufficient cooking.

Vegetarianism, and the use of uncooked foods, are advocated by certain groups, as systems on which individuals who desire to be healthy should base their daily dietaries.

Vegetarians hold that meat and flesh foods in general are not only unnecessary to the human family, but have an injurious effect. The claims are that vegetarians or those who restrict their diet to foods derived from the vegetable kingdom, with eggs and milk in addition, have greater endurance than meat eaters, and are generally healthier.

Meat eating is condemned for the following reasons by a small group of scientists:

"It causes an overconsumption of protein, which promotes certain diseases.

"It greatly promotes the growth of bacteria in the intestinal tract.

"It tends to rheumatic troubles through the increased accumulation of uric acid in the system.

"There is an increased danger from ptomain poisoning from the rapid fermentation of flesh foods."

These wholesale condemnations of meat eating have never been accepted as facts by the medical profession; though it is admitted that the excessive use of meat in the diet "places upon the human organism unnecessary burdens and promotes any tendency that may exist toward ailments associated with the by-products of protein metabolism."

"No proof is yet forthcoming that a reasonable diet of flesh and vegetables is any more dangerous to health through bacterial development than is a purely vegetable diet" (Jordan).

VEGETABLES

Vegetables may be divided into various classes. Nutritive vegetables and flavor vegetables is a convenient classification. Nutritive vegetables would include rice, potatoes, peas, beans, and lentils. Flavor vegetables would include those having mineral salts, but otherwise little or no food value. In this class are lettuce, celery, spinach, onions, radishes, cabbage, cucumbers, tomatoes, and turnips. There are also a number of vegetables which seem to be on the border between these classes. The flavor vegetables are useful in giving variety to the diet. Most vegetables contain a certain amount of woody fiber, which, though it is indigestible, serves a useful purpose in giving the bulk to the food needed for complete digestion and in stimulating peristalsis. Pungent vegetables, such as onions, radishes, etc., slightly stimulate the secretion of digestive fluids.

Rice contains a large amount of starch in an easily digested form. In general composition it resembles the potato. When combined with milk or other substances, which supply the protein and fat which it lacks, it is a useful food.

Beans, peas, lentils, and **peanuts** constitute the class of vegetables known as legumes. In food value they rank next to the cereals. Lentils are produced in France and other European countries, but are little used in America. All these foods contain protein and fat and are liable to cause intestinal fermentation in those with feeble digestive powers. When young they are a wholesome, nutritious, and easily digested food, but when old, if used at all for invalids, or after having been dried, they are best served in the form of purée. As they contain elements similar to meat, they can often be used as substitutes for flesh foods.

Potatoes contain a high percentage of starch, which, as a rule, is easily digested. If the potato is mealy or "floury" it is readily digested, but if after boiling it is close and "waxy," it is not a desirable food for invalids who have feeble digestive powers. The sweet-potato contains about 10 per cent. of sugar, is less easily digested than the white potato, and less suitable for the sick. Potatoes are most easily digested if cooked by baking in their skins. Steamed and mashed potatoes would rank next in digestibility. It is never advisable to give potatoes in chunks to invalids, or to children who have not been taught to thoroughly masticate their food. In a great many cases, when potatoes in solid pieces are swallowed, they pass undigested through the whole alimentary tract.

Potatoes contain certain mineral salts which are valuable as a preventive of scurvy. These salts are lost to a considerable extent when the potato is peeled before cooking.

(Scurvy is a disease resulting from malnutrition, said to be due to the lack of fresh vegetables and fruits in the diet. It has occurred in past years, to a considerable extent, among soldiers, sailors, and in prisons, and quite frequently among infants, both poor and rich. Hence, although many vegetables and fruits seem to have little nutritive value, they are essential to health).

Botanical Classification.—Vegetables are occasionally classified according to the parts of the plant used.

1. Roots and tubers, such as potatoes, beets, carrots. Succulent tubers include carrots, parsnips, turnips, salsify, and radishes.
2. Fruit, as squash, cucumber, tomato.
3. Leaf, as lettuce, cabbage, spinach.
4. Stem, as celery, asparagus, and rhubarb.
5. Flower, as cauliflower.

Sugars are an important form of vegetable food, but not necessary for life, if starch and fats are included in the diet. Sugars produce heat and force and tend to the production of fatty tissue in the body. Sugar possesses certain antiseptic or preservative properties, is highly concentrated, is quickly dissolved, and, therefore, taxes the digestive organs very little. When taken to excess it tends to fermentation, the appetite for other food is lessened, and also the digestive fluids.

In flatulent dyspepsia, gastritis, gout, rheumatism, obesity, diabetes, and in the uric-acid diathesis, sugar is usually forbidden entirely or used very sparingly.

Glucose or *grape-sugar* is present in almost all fruits and is manufactured from starch.

Saccharin is a substance derived from coal-tar. It is said to be 280 times sweeter than cane-sugar, is also an antiseptic, and is used as a substitute for sugar in diabetes and other diseases.

The chief sources of sugar are the sugar-cane and beet root. The maple tree yields some.

Honey is a form of cane-sugar gathered by bees from flowering plants.

The Candy Habit.—The intense activity of the growing child requires energy-producing food materials in abundance. There is a physiologic demand for sugar in children that is ordinarily met by its moderate use in cakes, desserts, etc. Indulgence in candy at any or all hours lessens the appetite for other wholesome foods which the body needs. Even in homes of wealth undernourishment in children has frequently been found owing to the too free use of candy and other sweet substances.

FRUITS

Fruits contain a considerable proportion of water, starch, sugar, and acids.

The **uses of fruits** are summed up as follows:[1]

1. To furnish nutriment.
2. To convey water to the system and relieve thirst.
3. To introduce various salts and organic acids which improve the quality of the blood and react favorably upon the secretions.
4. As antiscorbutics.
5. As diuretics and to lessen the acidity of the urine.
6. As laxatives and cathartics.
7. To stimulate the appetite, improve digestion, and give variety in the diet.

Fruits affording the most nutriment are bananas, dates, figs, prunes, and grapes.

The **digestibility of fruits** depends to a considerable extent on ripeness and freshness and the condition of the user. Fruits considered to be easily digested are grapes, oranges, grape-fruit, lemons, cooked apples, figs, peaches, strawberries, and raspberries.

Fruits less easily digested are melons, prunes, raw apples, pears, apricots, bananas, and fresh currants.

Fruits Most Suitable for Invalids.—Thompson gives the following: Lemons, oranges, baked apples, stewed prunes, grapes, banana meal (not the fruit pulp).

Bananas form the staple article of food in the countries in which they flourish, but are not easily digested. Banana meal is used to some extent in the form of gruel in cases of irritability of the stomach and nausea. It is said to possess certain advantages over the other starchy substances commonly used for that purpose.

Fruits with seeds or skins should not be given to young children nor to persons with feeble digestive powers.

Nuts possess decided nutritive properties, but have the reputation of being hard to digest. This difficulty frequently arises from insufficient mastication, and from the

[1] W. Gilman Thompson.

fact that they are usually eaten after a full meal. They are recommended to be taken as a substitute for meat or part of the meat at a meal. Peanuts are not really nuts, but legumes, which grow under ground. All nuts contain considerable fat. The cocoanut, chestnut, almond, and English walnut contain most nutriment. All nuts are best omitted from the invalid's dietary because of difficulty in digestion.

CONDIMENTS

The *chief uses of condiments* are as follows:

To give flavor and relish to food.

To stimulate appetite.

To promote digestion.

Many condiments have antiseptic and carminative properties. The principal condiments are: Salt, mustard, nutmeg, vinegar, horseradish, cinnamon, pepper, ginger, cloves, and vanilla.

Salt.—Of these, common salt is the most important. One authority states that the reason why salt is so extensively used is that in our methods of preparing foods they lose most of their original saline ingredients.

Vinegar is an antiseptic and acts as a preservative of food. It is believed by some medical writers that excessive use of vinegar lessens the red blood-corpuscles. It is said also to interfere with salivary digestion. In fact, the free or excessive use of any of the condiments is likely to cause irritation and disorder of the digestive organs.

Besides the condiments mentioned, there are various others, such as mint, thyme, parsley, sage, etc., which are used to improve the flavor of foods.

BEVERAGES

The three common and popular aromatic beverages—tea, coffee, and cocoa—though different in general characteristics, contain alkaloids which are almost identical.

Tea.—A great many varieties are imported into the United States, mostly from China, India, and Ceylon. The so-called green and black teas grow on the same plant,

the difference being in the time of gathering the leaves and the method used in preparing them.

Tannin is an astringent found in both tea and coffee. In strong solutions it gives rise to constipation and other digestive disorders and renders inert the gastric fluids. Green tea contains more than twice as much tannin as black tea. It is said that tannin is particularly likely to interfere with the digestion of fresh meats.

The stimulating properties of tea are due to the alkaloid thein, which is almost identical with caffein in its action.

Good Effects.—The good and bad effects of tea are questions on which decided differences of opinion exist, but most authorities agree that tea lessens fatigue, promotes clearness of mind and intellectual energy, and acts as a stimulant to the nervous system.

Green tea possesses more active properties than black. When milk and sugar are added to tea a certain amount of nutriment is supplied. Tea alone is not a food, but the use of tea leads to the introduction of hot water into the system, which assists the general functions.

Bad Effects.—If taken in large quantities or in strong solution tea causes sleeplessness, precipitates the digestive ferments, retards digestion, and may lead to muscular tremors and palpitation.

One noted medical writer[1] states that the best way to minimize the bad effects of tea on digestion is to make it very weak, use it sparingly, and drink it after, but not with, a meal. He claims that the addition of 10 grains of soda bicarbonate to each ounce of dry tea entirely removes this retarding effect on digestion.

Tea should never boil; the water used in making tea should be freshly boiled, and should be poured on the tea not more than two or three minutes before it is to be used.

Coffee is imported from Brazil, Java, Ceylon, and other countries. It consists of the berries or seeds of the coffee tree. The seeds are commonly known as coffee beans.

[1] Sir William Roberts.

It is frequently adulterated with chicory. The choicest coffee is said to be the Mocha or Arabian. An important part of the preparation of coffee is the roasting, which develops its aromatic properties. The best coffee is made from berries which have been freshly roasted and ground.

Coffee contains the volatile oil which gives it its peculiar aroma, less tannin than tea, and caffein. It can be made either as an infusion or a decoction. The latter method is most frequently used. If boiled long or left standing, it extracts more and more of the tannin and is more likely to interfere with digestion.

Good Effects.—Like tea, coffee is a stimulant to the nervous system, diminishes the sense of fatigue, stimulates the heart, increases the action of the kidneys, and is said to be slightly laxative.

Ill Effects.—It may produce heart-burn, cause torpidity of the liver, disturb digestion, and when used to excess produce various nervous symptoms. On children either tea or coffee act disastrously, giving rise to night terrors, nervousness, and tremor.

Postum is a coffee substitute made from cereals, which is relished by many, and leaves no ill effects.

Cocoa and **chocolate** are obtained from the cocoa bean, the seeds of a tree which grows in the British West Indies, Brazil, and other parts of South America. The kernels of the roasted seeds are known as "cocoa nibs."

Cocoa contains a considerable amount of fat, known as cacao butter, some starch, some albuminous substances, the volatile oil which gives it its peculiar aroma, and an alkaloid known as theobromin, which closely resembles thein and caffein.

Chocolate is manufactured from cocoa, with sugar and other flavoring substances added.

Cocoa forms a highly nutritious drink when prepared either with or without milk. The amount of oil it contains renders it a rich drink and liable to disagree with invalids who have feeble digestive powers.

CHAPTER XLIV

DIET FOR THE SICK

INTELLIGENT feeding of any invalid is only possible when the practise is based on a knowledge of foods in general and their adaptibility to diseased conditions. A nurse who only knows how to blindly carry out orders may tide a patient over a crisis successfully, providing the orders are so explicit and definite that "a wayfaring man though a fool need not err therein." But so many conditions enter into successful feeding, especially in acute diseases characterized by fevers, that it is rarely possible for even the most accurate and painstaking physician to anticipate all the needs of any one case, and leave orders accordingly. The nurse's judgment has to be relied on to a large extent in meeting the difficulties presented in many cases.

There are certain general symptoms present in all fevers, and local conditions may modify or exaggerate the symptoms of any fever. In all acute febrile conditions we may expect dry, hot skin, thirst, full pulse with increased rate, coated tongue, more or less digestive disorder, loss of appetite often amounting to a loathing of food, headache occasionally, pain in a greater or less degree in the back and limbs at some stage, and elevation of temperature. In all fevers there is increased tissue waste, due to a perversion of the physiologic processes.

In most severe febrile diseases the glands of the stomach and intestines that secrete digestive fluids are inactive and incapable of digesting enough food to keep pace with the rapid waste of tissue. There is nearly always an excess of urea in the urine, the amount often exceeding that excreted by an active healthy individual on a full diet. In severe cases "the stomach loses its normal office and becomes merely a conduit to pass the liquid food to the duodenum. Not perhaps that there is, except in extreme cases, an absolute abeyance of gastric secretion and gastric

action, but that they are reduced to so low an ebb that they count for practically nothing in the work of digestion." [1]

It should also be remembered that there exists in many cases a tendency to accumulation in the body of waste tissue products resulting from the rapid destruction of tissue. These waste products act as poison in the system, and as far as possible foods should be used that will not clog the system and that will favor elimination.

General Principles.—1. In acute febrile diseases all authorities agree that food should be in fluid form, so that it can be easily and quickly absorbed.

2. It should be given in small amounts and at comparatively short intervals.

3. It should be of such form and quality as to convey the maximum amount of nourishment with the minimum tax on the digestive powers.

4. Foods should be avoided that are likely to disagree with the present condition of the patient.

5. Food should be used to the greatest extent that is safe and possible, in order to lessen tissue loss.

6. Abundance of water should be given to replace the depleted fluids of the body, to lessen thirst, and carry off waste.

Most medical writers agree that less tissue waste results when the patient is supplied with plenty of the nitrogenous elements of food. The theory is that the proteid substance contained in the food is burned instead of the proteid elements stored in the body structures. The nitrogenous food given does not go to produce tissues, but to spare them from the excessive waste due to the fever.

In all fevers where there is regular remission it is better to increase the supply of nourishment during the hours when the fever is lowest. It is believed that better digestion and absorption are possible at such times, the tissues appearing to regain to some degree their power of assimilation.

[1] Sir William Roberts.

The foods chiefly relied on in the acute stage of fevers are milk, animal broths, eggs, and gelatin. Of these, in importance, milk stands first. There is, however, always the danger of milk coagulating in indigestible masses in the stomach unless properly administered, and the successful management of a fever case on an exclusive milk-diet requires intelligence and skill. Much of the distention of the abdomen and physical discomfort of typhoid fever patients is attributed by some physicians to injudicious methods of administering milk. As there is practically no other food that compares with milk in nutritive value and general desirability as a food for invalids, every nurse should study to administer it so that it will not disagree and will be easily digested and assimilated.

In a great many cases thin carefully cooked and strained gruels may be added to the milk that will increase its digestibility.

Gelatin prepared with various flavors is strongly recommended by some medical writers for use in fevers because of its value in preventing tissue waste. The gelatin may be added to many broths with advantage, because while broths contain mineral elements that the body needs, and water is also needed, they are not rich in actual nutritive substances.

The amount of nourishment contained in broths is a very variable quantity, and a good many specimens are little more than flavored water. One difficulty with broths is that if there is any tendency to diarrhea the use of almost any animal broth is likely to increase it. A small amount of cornstarch or arrow-root added to broth increases the nutriment and is usually well borne.

A milk-free diet, containing strained rice-water, oatmeal gruel, meat-juices, egg, gelatin, and zweiback, has been used with good results, and is strongly recommended by some physicians for use in typhoid fever.

A very light diet tray.

For the patient on light diet.

FOOD PREPARATION AND SERVING

In previous lessons the fact has been emphasized that the manner in which food is cooked and served has much to do with the appetite for it, and appetite has much to do with digestion.

It should be borne in mind that because the range of foods admissible in the invalid's dietary is limited, special care must be used in the preparation of the materials allowed, so that no carelessness or failure on the part of the nurse shall spoil the meal or cause a distaste for foods, or which would tend to monotony, when every effort should be made to secure variety. To give variety while adhering to simple, easily digested foods, to excite appetite, and at the same time avoid the use of "indigestibles" which the invalid often craves, calls for skill and good judgment.

In no other part of nursing do little things count for more, and the importance of the little things is rarely sufficiently appreciated until years of experience have been gained. It has been a source of astonishment in dealing with pupil nurses to find how few there are who on entrance to a hospital know how to prepare and serve a cup of tea, a piece of toast, or an egg so that the result could be pronounced "exactly right."

Essentials to Success.—These would include a great many details, but the very first is cleanliness.

1. *Cleanliness* of food, of utensils used in cooking, of all dishes used in serving, of tray linen, of the patient's hands, and general surroundings.

2. *Neatness.*—Next would come neatness. A meal and surroundings may be clean, but the tray be far from neatly or carefully set.

3. *Quality of Food.*—Food supplies should be the best quality obtainable; they should be fresh, there should be as much variety as is permissible.

4. *Preparation of Food.*—The methods used should be simple and the foods should be freshly cooked. Fried foods are not usually desirable for invalids. The sea-

soning and flavoring should accord, as far as possible, with the patient's tastes. Usually in sickness the sense of taste is very acute, and less seasoning is needed. Strong flavors should be avoided. Fat should be carefully removed before serving broths. Gravies containing much grease are undesirable for invalids whose digestion is at all impaired. Foods twice cooked or warmed over should, as a rule, be avoided.

5. *Temperature of food* is exceedingly important. Hot foods should be served hot, but not so hot that the patient has to wait for them to cool before he can eat. Hot food should be covered in transit. Cold foods should be cold, never lukewarm.

6. *Amount of Food.*—Care should be used to avoid serving too much at one time and still be sure that enough has been given to satisfy, unless the amount is restricted.

7. *Punctuality.*—This applies to both cooking and serving. Punctuality and regularity in serving meals to an invalid is quite as necessary as in giving medicines. In the cooking of foods the time needs to be carefully considered. Custards intended to be served cold should be cooked long enough in advance for the cooling to take place. Many foods are spoiled by standing after being cooked. A baked potato is delicious and easily digested when cooked just right and promptly served, but what is more unappetizing than a baked potato that has remained after cooking in a slow oven till it is soggy and half cold. Tea is appetizing if made with freshly boiled water and served within three minutes after infusion. It is spoiled if prepared too long in advance. These illustrations might be multiplied indefinitely. Ices should not be served at the same time the hot food is served.

8. *Artistic touches* count for much more in the serving of meals to invalids than to persons in health. A patient who had no desire for food will often be beguiled into taking it, and will relish it, if care is taken to present it in the most attractive form. Daintiness about serving nourishment is a great help in attracting the eye and arousing

interest. The prettiest dishes the place affords should be pressed into service, and when possible a change of pattern of dishes occasionally is worth while. If a single article or two of food only are to be served, a small tray rather than a large one should be used. Care should be used to avoid crowding a tray with too many dishes. It is better to use a second tray for serving dessert or fruit than to pile too much on one tray and have it lack in order and neatness. When the sick room is not too far from the kitchen, serving a meal in courses is a good plan. As far as possible the element of unexpectedness should enter into a meal.

Elaborate garnishing of dishes should be avoided, but a touch of green is always permissible, and lettuce, parsley, and watercress can be made to serve quite as useful a purpose in the sick room as elsewhere.

A spray of maiden-hair fern or any of the dainty green effects can sometimes be used for decoration. The use of flowers on a tray is laudable, but these should be restricted to a single blossom with a touch of green or a full-blown flower of some of the dainty varieties. However one may admire an American beauty rose or a peony, or a large bouquet of any kind of flowers, they are out of place on a tray. A real good joke or an apt quotation, clipped from some of the current journals and laid on a tray, will often add zest to a meal and divert the patient's thoughts from himself.

Cracked or unmatched dishes do find their way to invalid's rooms in hospitals. Green cups and blue saucers are hastily set together by careless nurses, but such blunders destroy any artistic effect the tray might otherwise have.

A great many dainty ways of serving bread have been discovered, and the same is true of potatoes and a great many of the simple foods.

9. *Position of the Patient.*—This is a highly important detail in the success of a meal. He should be made as comfortable as possible, and put in the most convenient position for taking the food. If he lies on his side, a small

pillow at the back helps to support him. If he is propped up, the pillows should be tucked in snugly at the base of the spine, and arranged so that the head will not be thrown forward on the chest nor be left without support. Grasping of any part of the body with the finger-tips is an uncertain and uncomfortable method of giving support. If the hand is placed behind the back, the full breadth of the hands should be used, and a small pillow between the hands and the patient will increase the comfort. In short, the task of eating and drinking should be made as easy, comfortable, and pleasant to the patient as it is possible to make it.

10. *General Details.*—A thoughtful nurse will be on the alert to promote the convenience and comfort of the patient in every way during the meal. She will not allow a glass or cup to stand in a pool of fluid in the saucer and drip every time it is carried to the patient's mouth. She will, if necessary, cut the meat into small pieces. She will assist in pouring the tea, if desirable, in removing dishes used to keep the food hot, in preparing eggs boiled in shells to be eaten; in removing soiled dishes if the tray is crowded. She will at once remove the tray after the meal has been taken. She will not be guilty of leaving milk or food standing around in the sick room in the hope the patient may suddenly desire it. Freshness, as far as it is possible to obtain it, is a good rule in all matters relating to food.

Feeding of Helpless Patients.—If the patient's head has to be raised to take the fluid food, it should be done by slipping the hand underneath the pillow, and raising it rather than lifting the head only. Care should be used never to have the glasses or cups too full.

As a rule, when a patient craves water or fluids and the amount is restricted, it is better to give it in a small glass which is nearly filled and allow him to empty it, than to give it in a large glass partly filled, which he is not allowed to drain.

Glass tubes used for feeding should be bent. Feeding-

The patient's convenience would have been promoted by having the teapot on this tray in the upper right-hand corner, and the teacup immediately in front of it in line with the plate.

A luncheon tray. (Photograph by courtesy of Woman's Home Companion.)

A luncheon rich in protein—cheese toast, beef balls, and ice cream. (Photograph by courtesy of Woman's Home Companion.)

A light dinner tray. Creamed codfish with potato border, lightly browned; toasted triangles, and orange basket. (Photograph by courtesy of Woman's Home Companion.)

cups should be held so as not to allow the fluid to flow too quickly.

Unconscious patients should have only fluid food, and it should be administered very slowly, from a spoon or medicine-dropper. Only a teaspoonful at a time should be given, and the nurse should be sure it is swallowed before giving more. If less than ½ dram is given it is not likely to be swallowed, as swallowing is not induced by a few drops of fluid.

When rectal feeding is necessary, the general rules given regarding administration of medicine by rectum should be observed.

HOSPITAL DIETARIES

The need for extreme accuracy in the arrangement of hospital dietaries has led to the adoption of certain standard diets suitable for the varying conditions of the patients. The following diet schedules afford a chance for variety for nearly all types of patients.

Liquid Diet

Feeding every two hours, 6 oz. each

Meat broths; meat juices; strained soups; fruit juices with water; albuminized drinks; cereal gruels; tea, coffee; cocoa (if permitted); milk (if permitted); Bulgarian milk.

Soft Diet

Feedings every three hours

Any liquid food; cream soups; milk—whole and Bulgarian; custards; junkets; ice-cream and ices; gelatin; cereals; eggs—soft cooked; milk toast—butter; blanc mange; stewed fruits—well cooked and strained; cottage cheese; tapioca; rice.

Light Diet—A

Any liquid food or foods on Soft Diet; purée of vegetables; potatoes, baked or mashed; rice; desserts—tapioca, rice, cornstarch puddings, prune whip; bread—white and

whole wheat; fruits—fresh and stewed; baked apples; jellies and preserves.

Light Diet—B

Light Diet A with the addition of meats: Chicken; sweet breads; lamb chops; tender steak; fish and oysters; all cooked vegetables.

General Hospital Diet

Breakfast

Orange, grapefruit, berries, or other fresh fruits; stewed fruits; shredded wheat biscuits, Dr. Price's All-grain Food, Ralston's Breakfast Food, rolled oats, bran or cracked wheat, with cream and little sugar; eggs, soft cooked, seven minutes or poached; corn muffins, graham muffins with butter and honey, syrup; white bread, toast, Vienna rolls; one cup coffee or cup of cocoa or glass of hot water and cream.

Dinner

Creamed vegetable soup; meat broths; meat soups without fat.

Roast beef, roast lamb, roast chicken, roast turkey without dressing; stewed chicken, stewed lamb; boiled and baked ham; broiled steak, broiled lamb chops; fresh fish, baked.

Cranberry jelly; fruit jellies.

Stewed or baked white onions, cauliflower, peas, corn, lima beans, okra, stewed or baked tomatoes, baked or broiled eggplant, artichokes, beets, oyster plant, carrots, spinach, asparagus, string beans, well mashed turnips, stewed celery; potatoes well mashed, baked or creamed; rice well cooked.

Raw tender celery, ripe olives.

White, graham, whole wheat rye, or corn bread or toast; Vienna rolls, corn muffins with butter, honey, and syrup.

Lettuce, tomato, and fruit salads with French or Mayonnaise dressing.

Crackers; cheese.

Stewed fruits; raw fruits; custards; gelatins; cornstarches; tapioca; junket; prune whip; blanc mange; soft vanilla ice-cream; light cakes, such as sunshine or sponge cake; English walnuts, pecans, raisins, dates, figs.

Bulgarian milk, hot water and cream, or cool water.

Supper

Mixed vegetable soups; creamed vegetable soups.

Spaghetti; Schmier Kase; Boston baked beans.

Eggs: poached, soft cooked, omelet.

Vegetables same as at lunch.

White, graham, whole wheat, rye or corn bread or toast, Vienna rolls, corn muffins with butter, honey, or syrup.

Stewed fruits; raw fruits.

Custards; gelatins; cornstarches; tapioca; blanc mange; prune whip; junket.

Bulgarian milk; glass of hot water and cream or cool water.

Low Protein Diet—General

Cereals: Oatmeal, shredded wheat biscuit, Ralston's Breakfast Food. Dr. Price's All-grain Food, Pettijohn. With cream and sugar.

Bread: Whole wheat, graham, rye, corn bread (coarse meal); graham rolls, bran biscuits, graham crackers, Educators, Triscuit. With cream and sugar.

Green vegetables: Spinach, asparagus, eggplant, oyster plant, carrots, beets, beet greens, cauliflower, cabbage; Brussels sprouts, squash, baked pumpkin, gumbo, green peas, lettuce, tomatoes, rhubarb, kohlrabi.

Starchy vegetables: Potatoes, rice, spaghetti, hominy grits.

Stewed fruits: Peaches, pears, apricots, plums, prunes, cherries, cranberries, berries of all sorts, figs, apples, apple sauce, baked apples. Canned fruits are satisfactory if recooked. No preserves. Fruit jellies. Oranges and grapefruit, but no other uncooked fruits.

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SECTION VII

Invalid Cookery

CHAPTER XLV

SUGGESTIONS TO TEACHERS

The lessons on invalid cookery which follow have been arranged to proceed along with and to complete the teaching of dietetics. They have been inserted in this text-book because observation has taught that in many hospitals cookery lessons are neglected, while much time is consumed in teaching less important subjects.

A second reason for including these lessons is because a course in dietetics is decidedly insufficient and incomplete if no practical instructions are given.

The third reason is, because progressive physicians are placing more and more value on proper diet as a weapon in overcoming disease, and no twentieth century nurse can be considered fully trained if she has not been taught how to prepare foods of all kinds for the sick. "If I can control the kitchen connected with the sick room, I can get along with a large proportion of my patients with little or no assistance from the drug store," was a remark made to the author by a prominent physician, and which serves to show the necessity of nurses being capable in the kitchen if they are to meet the demands of the best modern physicians.

Another reason is because the author has received numerous letters from the nurse superintendents of small

hospitals, asking for advice and help as to how to arrange for classes in cookery. Many hospitals are in small places where a specially trained teacher of dietetics is not available, and if cookery classes are to be held at all, the nurse superintendent must conduct them. It has been with that class of teachers especially in view, rather than trained dietitians, that these directions have been prepared, in the hope of making it easier to introduce a course in practical cookery into such schools. If a visiting dietitian can be secured for the practical work, it should be done. Much of the theoretical part of the work may be covered in general class work before lessons in invalid cookery are begun.

The primary meaning of "nurse" was to nourish, and, though the conception of nursing broadens with the years, the subject of nourishment—of proper food for the sick and how to prepare it—is to-day receiving more attention than ever before.

It is unfortunately true that a great many young women enter hospital schools who have no more definite idea of how to prepare food for invalids than they have of general nursing or medicine or surgery. No subject in the nursing course precedes practical nursing in importance, and proper feeding is certainly an important part of practical nursing.

It is expected that the teacher of cooking will give a short explanatory talk bearing on each lesson before beginning practical demonstrations. It is not supposed that all the recipes included in every lesson outlined can be demonstrated in one class period, but a choice can be made of those considered most important. The season at which the lessons are given must also be taken into account, for though most foods can be gotten out of season, it hardly seems wise to purchase fresh fruits or vegetables out of season at exorbitant prices for teaching purposes.

If possible, it seems best to have the class held at an hour just previous to a meal, so that the products of the lesson may be utilized to give variety to the meal. There is always a special incentive to excel if the article of food is

intended for some individual, which incentive is lacking when the work is done simply for practice. Besides, there is a pecuniary reason why food materials should be utilized.

As the management of the fire has a great deal to do with success in cooking, some explanations regarding this point should be given the class in a preliminary talk. Because gas is so readily controlled in cooking, it is an especially convenient fire to use in teaching beginners, but the important points in the management of a coal stove should also be mentioned.

Proper cooking utensils to use in preparing and cooking foods should also receive comment. Utensils that make no unnecessary labor should have the preference. Individual frying pans, egg-beaters, and mixing bowls and spoons should be provided for the class. These are all inexpensive articles, which can be utilized in various ways apart from class work.

The methods of cleaning the utensils after use, the best cleaning agents to use, and the place in which each utensil is to be kept, should not be omitted in teaching.

There are a few general principles which have much to do with final success:

1. *Cleanliness* of food materials, utensils, cook, and surroundings.

2. *Order.*—All articles needed for preparing a food should be collected before the mixing of the ingredients begins.

3. *Economy.*—The principle of sensible economy in the use of all materials should be insisted on. It is, however, a false economy that will run the risk of spoiling an article of food by the use of inferior ingredients, or by leaving out some ingredient necessary to success. It is, nevertheless, a triumph of culinary skill to be able to make appetizing dishes out of inexpensive materials or "left-overs." A well-trained cook is never wasteful. In fact, waste in any line, whether it be of human energy or material, is a sign of lack of intelligence.

4. *Attention to Details.*—An experienced cook may be

able to apparently neglect the business on hand for the moment or attend to a dozen things at once, but when an amateur cook tries to do the same thing the result is reasonably certain to be a failure. Therefore, "pay careful attention to the work on hand" is a rule worthy of special emphasis with amateur cooks.

5. *Accuracy.*—An experienced cook may be able to guess at quantities of ingredients, but the only safe rule for a beginner in cooking is to measure quantities as accurately as possible, calculate time carefully, and follow rules. A point at which many inexperienced cooks make mistakes is in calculating the time needed for jellies to set, custards to cool, etc., and much disappointment results. The season of year has a little to do with this point, which should be discussed in class.

A celebrated artist was once asked the question, "What do you mix your paints with?" "Brains," was the reply, and it applies with equal force to cookery for invalids. Real success depends on a great many apparently trivial details. The materials used are subject to many variations. The size of an egg, and even the temperature, need to be considered to a certain extent. One egg may contain one-half as much more material as another. An egg taken out of the refrigerator will require longer to boil than one kept in the ordinary living-room temperature. Starch is not always equally dry; flour varies; some vegetables yield much more liquid than others; cups and spoons are of various sizes; lemons differ in the amount of juice, and more sugar may be needed than a rule calls for; the quality of meat is subject to great variations; the heat of the oven is not always the same. These are only examples of a great many causes that modify results. No cookery book, however carefully arranged, can always supply infallible recipes. These modifying conditions must be taken into account. Plain, common, every-day sense and intelligence must be brought to bear on the ingredients and general conditions.

CHAPTER XLVI

BEVERAGES AND FLUID FOODS

Lesson I

Water is classed as a food because it is essential in forming the tissues and fluids of the body.

Water suspected to be contaminated should not be used for drinking without boiling, nor for washing uncooked foods.

Tea should always be made with freshly boiled water, but never boiled.

Neither tea nor coffee should be depended on as nourishment, except as water adds to the tissues of the body.

Tea should always be freshly made and used immediately. Long infusion renders it injurious.

Cocoa and chocolate have a nutritive value and, when milk is added, are useful as foods.

Coffee should be made with freshly boiled water. Like tea, it becomes injurious from long standing by the extraction of tannin.

One pint of milk is said to be equivalent in food value to 6 ounces of beef or mutton.

Milk becomes solid by the action of the gastric fluids when it enters the stomach.

When swallowed quickly the casein has a tendency to form in lumps.

Milk diluted with water, hot or cold, is easier to digest than pure milk.

Skimmed milk contains nearly all the protein of the milk.

LEMONADE OR ORANGEADE

Ingredients: 1 lemon or orange, ½ pint of water, 2 tablespoonfuls of sugar, 1 tablespoonful of crushed ice.

Method.—Roll lemon or orange until soft; remove juice, being careful to exclude seeds; add sugar; mix; add water; mix well; pour over ice and serve at once. May be made with hot water if desired.

EFFERVESCING LEMONADE

Ingredients: Same as above, with ¼ teaspoonful of soda added just before serving.

Method.—Stir well; serve while effervescing.

FLAXSEED LEMONADE

Ingredients: 2 tablespoonfuls of whole flaxseed, 1 tablespoonful of sugar, 2 tablespoonfuls of crushed ice, 1 quart of hot water, juice of 1 lemon.

Method.—Look over and wash flaxseed; pour boiling water over the seed and steep (do not boil) for two hours; strain; add lemon juice and sugar; cool, and pour over ice. May be served hot if desired.

ALBUMEN-WATER

Ingredients: White of 1 egg, ½ lemon or orange, 2 tablespoonfuls of crushed ice, a little sugar, water enough to fill glass.

Method.—Beat egg slightly; add lemon juice and sugar; strain through fine strainer over ice; mix well; fill glass with water and serve.

BARLEY-WATER

Ingredients: 2 tablespoonfuls of pearl barley, 1 quart of cold water, 1 tablespoonful of lemon juice, 1 teaspoonful of sugar, ½ teaspoonful of salt.

Method.—Look over and wash barley; soak for two hours; pour off water and add fresh; then cook in double boiler until soft; strain through coarse strainer; add salt, sugar, and lemon juice. The lemon juice may be omitted and cream used instead, if preferred. Serve hot.

OATMEAL-WATER

Ingredients: ½ cupful of oatmeal, 1 quart of cold water, ½ teaspoonful of salt.

Method.—Soak oatmeal in water for one hour; cook in double boiler for one hour or until soft; add salt; strain through coarse strainer; serve hot or cold.

TOAST-WATER

Ingredients: 1 thick slice of bread, ¼ teaspoonful of salt, 1 cupful of hot water.

Method.—Cut bread in cubes; toast brown in oven; pour water over toast; add salt; let stand covered until cool; strain; serve either hot or cold.

TEA

Ingredients: ½ teaspoonful of tea (if Ceylon), 1 teaspoonful (if any other kind), 1 cupful of boiling water.

Method.—Scald teapot; place tea in pot; add boiling water; let stand in warm place for two minutes; serve at once. (Caution: Be sure the water boils before pouring on the tea.)

SLIPPERY-ELM TEA

Ingredients: 2 teaspoonfuls of slippery-elm powder or a piece of slippery-elm bark (about 2 ounces), 1 cupful of hot water, 1 tablespoonful of sugar, 1 teaspoonful of lemon juice.

Method.—Pour hot water over powder; let stand covered until cool; strain; add sugar and lemon juice; serve either hot or cold. If bark is used, steep one-half hour before straining.

BEEF-TEA

Ingredients: 1 pound of lean beef, 1 pint of cold water, ½ teaspoonful of salt.

Method.—Wipe meat with damp cloth; cut in ½-inch cubes; put in quart jar; add salt and water; cover, keep in cool place for four hours until juices are well started, then place jar in pan of cold water on back of stove and bring slowly to a boil; strain and serve. It may be served hot or frozen if desired.

BEEF JUICE

Ingredients: ½ pound of lean beef (round steak is best), ¼ teaspoonful of salt.

Method.—Wipe meat with damp cloth, place in wire broiler; heat over hot fire, but do not brown; cut in small pieces; press through meat press (always heat the press and bowl); add salt; serve in colored glass.

If meat is heated in frying pan, a bay leaf or celery stalk may be heated with it, giving it a different flavor. Beef-juice may be made like beef-tea by omitting water.

COFFEE AND EGG

Ingredients: Yelk of 1 egg, ½ cupful of hot coffee, ½ cupful of hot milk.

Method.—To the well-beaten yelk add coffee and milk.

COCOA

Ingredients: 2 teaspoonfuls of cocoa, 1 teaspoonful of sugar, 2 teaspoonfuls of hot water, 1 cupful of hot milk.

Method.—Mix cocoa and sugar; add hot water; stir until dissolved; add milk and bring to a boil; beat with a Dover egg-beater until it foams or place a spoonful of whipped cream on top of cup before serving it; serve hot.

POSTUM CEREAL

Ingredients: 1 tablespoonful of postum cereal, 2 cupfuls of water, ¼ teaspoonful of butter.

Method.—Place postum in the pot; add water and butter and boil for twenty minutes; let stand for one minute to settle; strain and serve at once, with cream and sugar.

WHEY

Ingredients: 1 pint of milk, 2 teaspoonfuls of essence of pepsin.

Method.—Heat milk to 100° F.; add pepsin; whip lightly with a fork to separate the curd; strain through a fine strainer. Serve cold.

MILK-PUNCH

Ingredients: ½ pint of milk, 2 teaspoonfuls of sugar, 2 tablespoonfuls of brandy or sherry.

Method.—Dissolve sugar in milk; add brandy; mix well, and serve.

EGG BROTH

Ingredients: 1 egg, ½ teaspoonful of sugar, 1 pint of boiling water, ½ teaspoonful of salt. Milk may be used instead of water and a small piece of butter added if desired.

Method.—Beat egg and sugar until very light; add boiling water, stirring all the time; add salt. Serve at once.

EGG FLIP

Ingredients: 1 egg, ½ teaspoonful of sugar, 1 wine glassful of sherry or brandy.

Method.—Beat yelk of egg and sugar until light and creamy; add spirits; beat white of egg till stiff; fold into mixture. Serve at once. Two tablespoonfuls of lemon juice may be used instead of spirits.

KOUMISS

Ingredients: 1 quart of milk, 2 tablespoonfuls of sugar, 1 tablespoonful of warm water, ¼ cake of compressed yeast, three or four bottles with tight corks.

Method.—Heat milk to blood heat; add sugar and yeast dissolved in warm water, fill bottles three-quarters full; cork securely; invert; keep at a temperature of 80° or 100° F. for six hours. Cool, and it is ready to serve.

EGG-NOG

Ingredients: 1 egg, 1 tablespoonful of sugar, 1 cupful of milk, 1 teaspoonful of vanilla or 1 tablespoonful of wine, 1 tablespoonful of crushed ice.

Method.—Beat egg and sugar until light; add milk; fold in stiffly beaten white; add flavoring; mix well; pour over crushed ice and serve. If wine is used, add ice-water before adding milk. May be served hot by omitting white of egg and heating milk.

PEPTONIZED MILK

Ingredients: ½ pint of milk, 1 gill of water, 1 small tablespoonful of liquor pancreaticus, 20 grains of soda.

Method.—Add water to milk; heat to 140° F. (do not boil). Add other ingredients; place in bottle; cork with absorbent cotton; keep in warm place for one hour, and put on ice.

LABAN

Ingredients: 2 quarts of sweet milk, ¼ cake of compressed yeast, warm water enough to dissolve the yeast.

Method.—Heat milk lukewarm (98° to 100° F.); dissolve yeast in warm water; add to warm milk; put in warm place (even temperature of about 70° F.) for ten hours, then whip with Dover egg-beater or fork until very smooth. Put in jars and keep in cool place until needed. Save a cupful of mixture and use instead of yeast. The first may be too strong of yeast; if so, discard, and use a cupful of mixture and proceed as directed.

COFFEE (PLAIN)

Ingredients: 1 tablespoonful of coffee, ½ pint of boiling water, 1 teaspoonful of white of egg.

Method.—Mix coffee and egg; wet with cold water; add hot water; bring to boil; keep hot, but do not boil, for five minutes. Serve hot with cream or hot milk.

Another Method.—Mix coffee and egg; add ½ pint of cold water; bring to a boil; let stand on back of stove for five minutes to settle, then serve as above.

French or filtered coffee is made by placing coffee in strainer in coffee-pot and pouring boiling water through until strong enough.

COFFEE (BLACK)

Ingredients: 1 cupful of ground coffee, 1 pint of water.

Method.—Same as plain coffee, omitting the egg. It may be boiled for one minute; strain. Used as a stimulant in case of collapse.

MILK COFFEE

Ingredients: 1 tablespoonful of ground coffee, ½ cupful of cold water, 1 cupful of hot milk.

Method.—Put coffee in coffee-pot; add water; bring to a boil; let stand for five minutes; strain; add hot milk. Serve at once.

MALTED MILK (COLD)

Ingredients: 1 tablespoonful of malted milk, ¾ cupful of cold water, 1 tablespoonful of hot water.

Method.—Dissolve malted milk in hot water; add cold water; stir until well mixed or place in a soda-water shaker and shake until dissolved. A tablespoonful of hot coffee, cocoa, or flavoring of any kind desired may be used.

MALTED MILK ICE-CREAM

Ingredients: 2½ tablespoonfuls of malted milk, 1 cupful of water, 1 tablespoonful of sugar, 1 tablespoonful of cream, ½ teaspoonful of flavoring.

Method.—Mix milk and sugar; dissolve in water; add cream and flavoring; stir well; freeze. White of an egg (stiffly beaten) may be added if a richer cream is desired.

CHAPTER XLVII

EGGS

Lesson 2

Protein and fats are the chief ingredients of eggs. Some mineral substances and water are found in them.

The fat of eggs is found largely in the yelk.

The albumen or protein of the egg is mostly found in the white part.

The shell of the egg is porous and may absorb disagreeable odors.

Eggs should not be placed in contact with onions, fish, kerosene, or other strong-smelling substances.

Eggs kept in the ice-box will require a longer time to boil than if kept in a warm place.

Hard-boiled eggs should be slowly and thoroughly masticated.

The yelk of the egg contains more nutriment than the white.

Unless ordered, eggs should not be given in cases of severe gastric derangement or in flatulent dyspepsia.

When poaching eggs, if rings are used to hold them, the edges will be in better shape. Yelks of eggs may be saved by covering with cold water when not needed immediately. In that way they will keep soft and fresh, and may be used for custard or pudding and in various other ways in the kitchen.

CODDLED EGGS

Ingredients: 1 egg, 1 cupful of boiling water, ⅛ teaspoonful of salt.

Method.—Break the egg into egg-cup; add salt; pour boiling water carefully over, and let stand six or eight minutes in a hot place; remove water very carefully. Serve at once in cup in which it is cooked. Strips of bread and butter arranged log-cabin fashion may be served with it.

POACHED EGG IN MILK

Ingredients: 1 egg, 1 cupful of hot milk, ⅛ teaspoonful of salt, 1 slice of toast.

Method.—Heat milk; add salt; drop egg, being careful not to break the yelk. Cook gently (do not boil) for five minutes. Toast bread a golden brown; cut in rounds; butter; place an egg on toast; pour remainder of milk over; garnish with parsley. Serve at once.

EGG COOKED IN SHELL

Method.—Place egg in bowl on back of stove and pour boiling water over it; let stand covered from six to eight minutes if desired soft, and from twelve to fifteen minutes, if hard.

CREAMED EGG

Ingredients: 1 egg, ¼ cupful of milk, ½ tablespoonful of butter, ¼ teaspoonful of salt, 1 slice of toast.

Method.—Beat egg slightly; add salt; heat milk and butter in double boiler; add egg; cook until creamy (about three minutes, stirring all the time); toast bread a golden brown; remove crust; place egg on toast. Serve at once. Garnish with cress.

EGG IN BATTER, OR SCALLOPED EGG

Ingredients: 1 egg, 2 tablespoonfuls of cream, 2 tablespoonfuls of bread-crumbs, ¼ teaspoonful of salt.

Method.—Mix cream, bread-crumbs, and salt. Butter an egg-cup; put one-half the mixture in cup, then the egg, cover with the remainder of mixture; bake five or six minutes in a moderate oven. Serve at once in cup used for baking.

SHIRRED OR BAKED EGG

Method.—Break egg in buttered dish; add salt; bake in moderate oven until white is firm (about five minutes). Serve in same dish. Garnish with strips of bread and butter.

SCRAMBLED EGGS ON TOAST

Ingredients: 1 egg, 1 tablespoonful of milk, 1 teaspoonful of butter, ⅛ teaspoonful of salt, 1 slice of toast.

Method.—Beat egg slightly; add milk and salt; melt butter in frying pan; add mixture; cook until creamy, stirring very gently. If rightly managed, it will be soft, creamy, and toothsome; if wrongly, tough and stringy. Toast bread a golden brown; roll crust; butter and moisten slightly; pour egg on toast; garnish with parsley. Serve at once.

POACHED EGG

Ingredients: 1 egg, hot water, ½ teaspoonful of lemon juice or vinegar, 1 teaspoonful of butter, 1 slice of toast.

Method.—Break egg in pan of water in which lemon juice is dissolved; cook without boiling until yelk is covered with white film; remove carefully; place on buttered toast. Serve at once.

EGG SOUFFLE

Method.—Separate white and yelk; beat white till stiff; place in heavy tumbler; add salt; place glass in pan; add warm water; place cloth in pan to set glass on; have the water about three-quarters up the glass; bring to a boil; cook until white rises to top of glass; make a depression in the center; drop the yelk in very carefully so as not to break; cook about two minutes or until the yelk is set; remove and serve at once, with strips of bread and butter.

OMELET

Ingredients: 1 egg, 1 tablespoonful of butter, 1 tablespoonful of milk, 1 tablespoonful of bread-crumbs, ¼ teaspoonful of salt, a dash of pepper.

Method.—Separate egg; beat white till stiff; cream yelk; add to bread-crumbs and milk; mix; add salt; fold in stiffly beaten white; place butter in well-cleaned omelet pan; heat; add mixture; cook on top of stove slowly until well risen; place on rack of oven until firm; remove carefully to a hot plate; garnish with parsley. Serve at once. May be varied by using minced chicken or meat of any kind, or vegetables in place of bread-crumbs.

EGG NESTS

Ingredients: 2 eggs, 2 slices of toast.

Method.—Divide the whites and yelks of the eggs, being careful to keep the yelks unbroken; have the toast buttered and cut in rounds. It may be moistened with a little soup stock if desired. Use only one-half the whites of the

eggs; beat to a stiff froth and heap on the rounds of toast. With the ends of the shell make a hollow in the center of the mound, drop in the yelk, sprinkle with salt and pepper. Drop on some tiny pieces of butter and set on the top shelf of an oven not too hot. The heat should allow for the egg to be in the oven at least four minutes before browning. The toast may be sprinkled with grated cheese or finely minced meat. Tomato sauce may also be served with it.

RICE OMELET

Ingredients: ⅓ teacupful of cold boiled rice, ⅓ cupful of milk, 1 teaspoonful of melted butter, 1 egg, salt as needed.

Method.—Warm the cold boiled rice in the milk and add the melted butter; beat yelk and white of egg separately; stir the yelk into the other ingredients, and, lastly, fold in stiffly beaten whites; pour into a very hot, well buttered, individual frying pan; let it brown for one minute; put on the top of the oven to set the top, and fold and serve as usual.

PLAIN OMELET

Method.—Put 2 eggs into bowl; add salt and pepper as desired; beat vigorously for twelve minutes with fork, and add 1 tablespoonful of milk or cream.

Into a small hot frying pan put a teaspoonful of butter; pour in the egg and shake over the fire till it is set; roll, and serve on a hot dish. Grated cheese or minced chicken or ham may be spread over before rolling it.

OX EYES

Method.—Take 2 slices of bread 1 inch thick; cut in rounds, and cut a circle about 1½ inches in diameter out of the center with a sharp tin cutter; spread lightly with butter; place in baking pan; break a fresh egg into each circle; put little bits of butter over the egg, and season with salt and pepper; moisten with a tablespoonful of sweet cream or rich milk, and put into the oven till the eggs are lightly set.

CHAPTER XLVIII

SEMISOLID FOODS

Lesson 3

Potatoes and most cereals contain large quantities of starch. Other substances containing much starch are arrowroot, tapioca, sago, and corn.

Farinaceous foods are a subdivision of starchy foods, and include rice, tapioca, etc. In a farinaceous diet milk and butter are usually added and all other animal foods excluded.

Milk-diet consists of from 2 to 3 quarts of milk per day, all other foods excluded.

Nitrogenous diet consists mainly of animal foods. Foods yielding sugars and starches are excluded, excepting sometimes dried or brown bread or toast.

Thorough cooking of starchy foods is very important. Cooking causes the bursting of the outer envelope which encloses the starch granules, making them soluble and fit for digestion. These granules are insoluble in cold water.

The first stage in the digestion of starchy foods begins in the kitchen.

The need of thorough mastication of starchy foods should be impressed on every invalid.

CEREALS

RICE

Ingredients: 2 tablespoonfuls of rice, 1 pint of boiling water, ½ teaspoonful of salt.

Method.—Wash rice; slowly scatter in boiling water; add salt; cook in double boiler about one hour or until tender; the kernels should be distinct. Serve hot with cream and sugar.

CREAM OF WHEAT

Ingredients: 1 tablespoonful of cream of wheat, 1 cupful of boiling-water, ¼ teaspoonful of salt.

Method.—Scatter wheat in salted boiling water, stirring constantly to prevent lumping; cook in double boiler for one-half hour. Serve hot with cream and sugar. All fine cereals may be cooked in this way.

HOMINY

Ingredients: 1 tablespoonful of fine hominy, 1 cupful of boiling water, ¼ teaspoonful of salt.

Method.—Scatter hominy in salted boiling water; cook in double boiler for one hour. Serve hot with cream or butter and sugar.

OATMEAL OR CORNMEAL MUSH

Ingredients: 1 tablespoonful of meal, 1 cupful of boiling water, ¼ teaspoonful of salt.

Method.—Scatter meal in salted boiling water; cook in double boiler for at least one hour. If cornmeal is used, moisten with cold water before adding to the boiling water, and cook. Serve hot.

OATMEAL GRUEL

Ingredients: 2 tablespoonfuls of oatmeal, 3 cupfuls of water, ½ teaspoonful of salt, ½ cupful of hot milk.

Method.—Soak oatmeal over night in the water; in the morning add salt; cook in double boiler for two hours; strain; add hot milk. Serve either hot or cold.

FLOUR GRUEL

Ingredients: 1 tablespoonful of flour, 1 cupful of hot milk, ¼ teaspoonful of salt.

Method.—Mix flour and salt; add cold water to make a thin paste; add to hot milk; cook in double boiler for one-half hour. Serve hot or cold.

CRACKNEL OR CRACKER GRUEL

Ingredients: 2 cracknel biscuits or crackers, 1 cupful of boiling water, 1 cupful of milk, ¼ teaspoonful of salt.

Method.—Brown cracknel in oven till a light brown; crush or roll fine; add salt; moisten with milk; cook in double boiler for five minutes. Serve hot.

BAKED CUSTARD

Ingredients: 2 cupfuls of milk, 2 eggs, 1 tablespoonful of sugar, ⅛ teaspoonful of salt, a grating of nutmeg.

Method.—Beat eggs slightly; add sugar, salt, and milk; mix well; pour in well-buttered custard cups; grate nutmeg over top; set in pan of water; bake in moderate oven until firm. Any flavoring desired may be used. Serve cold in cups in which they are baked.

JUNKET (PLAIN)

Ingredients: 1 pint of milk, ½ junket tablet, 1 teaspoonful of cold water, 2 tablespoonfuls of sugar, ½ teaspoonful of vanilla or any flavoring desired.

Method.—Dissolve tablet in water; heat milk to 100° F.; add sugar; stir until dissolved; add dissolved tablet and flavoring; stir well; pour in sherbet cups; set in warm place until firm; remove carefully to ice-box; serve cold, plain, or with whipped cream on top. May be varied by using different flavoring. Egg yelk may be added to milk before junket tablet is added, or meringue of the white of egg to top before serving. Cocoa may be used in place of one-half of milk. Fruit sauces may be used with junket for variety. Garnish with a few fresh berries in season when fruit is permissible.

MILK-TOAST

Ingredients: 2 thick slices of toast, 1 cupful of hot milk, ⅛ teaspoonful of salt, a bit of butter.

Method.—Remove crust and butter; place in hot bowl; pour hot milk over. Serve at once. May have sugar added if desired.

BLANC MANGE

Ingredients: 2 cupfuls of milk, 1 tablespoonful of cornstarch, ¼ teaspoonful of flavoring.

Method.—Mix sugar and cornstarch; make into a smooth white paste with cold water; heat the milk in double boiler; add paste; stir until smooth; cook for ten minutes; remove from fire and add flavoring; pour in mold; set in cold place. Serve with whipped cream and sugar.

GELATIN (PLAIN)

Ingredients: 1 tablespoonful of granulated gelatin, 2 tablespoonfuls of cold water, 1 tablespoonful of sugar, 1 cupful of boiling water, ½ tablespoonful of lemon juice.

Method.—Soak gelatin in cold water for five minutes; add boiling water, sugar, and flavoring; stir until dissolved; pour in mold; set in cold place until firm; serve cold with cream and sugar. Any flavor may be used. Fruit juice or coffee may be used in place of water, but should be hot before adding to the gelatin.

BOILED CUSTARD (THIN)

Ingredients: 1 pint of milk, 1 teaspoonful of cornstarch, ½ teaspoonful of flavoring, ½ cupful of sugar, a dash of salt, 1 egg.

Method.—Heat milk in double boiler; blend sugar and cornstarch; add to heated milk; cook until it thickens; remove from fire; add well-beaten egg and salt and flavoring. If wanted thicker, add more cornstarch. If desired, may be served with sliced oranges or bananas.

MALTED MILK BLANC MANGE

Ingredients: 2 tablespoonfuls of malted milk, 2 tablespoonfuls of arrowroot, 1 tablespoonful of sugar, 1½ cupfuls of water, ¼ teaspoonful of vanilla.

Method.—Mix milk and arrowroot; add water to make smooth paste; add sugar, flavoring, and the rest of water; boil until it thickens, stirring all the time. Serve either hot or cold with cream.

MALTED MILK CUSTARD

Ingredients: 2 tablespoonfuls of malted milk, 1 cupful of water or milk, 1 tablespoonful of sugar, yelks of 2 eggs, a pinch of salt.

Method.—Mix malted milk, sugar, salt; add water; stir until dissolved; add well-beaten egg yelks; pour in buttered cups; grate nutmeg over; bake in pan of water in moderate oven until set (about twenty minutes). Serve cold in cup in which it is baked.

CHAPTER XLIX

SOUPS AND PURÉES

Lesson 4

THE water in which meat is boiled is termed broth or bouillon.

Consommé is a clear soup made from beef or mutton. Clear broth contains certain salts and soluble extractives, some gelatin, little or no albumin, and very little nutritious substance. It is slightly stimulating to the digestive organs.

In preparing soup stock, prolonged cooking is necessary to fully extract the gelatin. The floating coagulated albumin is skimmed off with the fat or strained.

Purée is strained, thickened vegetable soup.

If meat is cut into small pieces, put into cold water, the temperature raised gradually to 160° F., and actual boiling avoided, more of the albumin will be extracted.

The method of cooking determines largely the amount of the soluble constituents that will be extracted from the meat.

Soups are thickened with flour, cornstarch, or rice-flour. Cornstarch gives a smooth, more velvety soup than flour.

The soup should always boil at least twelve to fifteen minutes after the thickening is added, that the starch may be thoroughly cooked.

A thickened soup should be about the consistency of good cream. Purées are thicker.

A tablespoonful of flour to 1 quart of soup is the rule, and the amount of cornstarch slightly less.

Sago, tapioca, rice, or farina may be used instead of the flour or cornstarch, but require longer cooking.

CLAM BROTH

Ingredients: ½ dozen of fresh clams, 1 cupful of water, 1 cupful of milk, ½ teaspoonful of salt, a bit of butter, a dash of pepper.

Method.—Wash clams; cut in small pieces; add water and salt; bring to a boil; skim; add milk, butter, pepper; bring to a boil; strain if patient may not have the clam meat. Serve hot with toast or crackers.

OYSTER BROTH

Ingredients: ½ cupful of oysters, 1 cupful of water, ¼ teaspoonful of salt, a dash of pepper.

Method.—Wash oysters; place in saucepan; heat; skim; add water, salt, and pepper; bring to a boil. Serve very hot with oysterettes.

Oyster stew is made without cutting the oysters, and using milk, crumbs, crackers, and 1 teaspoonful of butter. Serve hot, as above.

BEEF OR MUTTON BROTH

Ingredients: 2 pounds of lean beef or mutton (shank of beef or neck of mutton), 2 quarts of cold water, 1 teaspoonful of salt, 3 tablespoonfuls of rice or barley, 2 bay leaves, 1 stalk of celery.

Method.—Wipe meat with damp cloth; remove fat and skin; cut in pieces; break the bones; place all in soup kettle; add salt and cold water; heat gradually to the boiling-

point, but do not boil; skim as scum rises to the top; simmer for three or four hours; strain; cool; remove all fat; add rice, celery, bay leaf, and cook until rice is soft, but do not boil. Serve hot with croutons or wafers.

CHICKEN JELLY

Ingredients: ½ chicken or fowl, 1 quart of cold water, ½ bunch of parsley, 1 teaspoonful of salt, 2 stems of celery.

Method.—Clean, wash, and skin chicken; cut in small pieces, being sure to use all the bones; place in stew pan; add celery, the stems of the parsley, but not the leaves; salt; pour cold water over all; simmer (do not boil) until the chicken falls to pieces; strain; stand over night or until cold; remove fat. Should be clear, firm jelly.

CHICKEN MILK

Ingredients: 1 cupful of chicken jelly, 1 cupful of milk.

Method.—Place in stew pan and bring to boil. Serve hot with strips of toast, or may be served cold in jelly form.

TAPIOCA CREAM SOUP

Ingredients: 1 pint of stock, 1 cupful of cream or milk, 1 heaping tablespoonful of tapioca, 1 small onion, 1 stalk of celery, 2 teaspoonfuls of butter.

Method.—Wash and soak the tapioca and cook in just sufficient water to keep from burning for one hour; cut onion and celery into small pieces and cook for twenty minutes in the stock, add the milk to the stock; stir in the tapioca; add butter, salt, and pepper; simmer slowly until tapioca is thoroughly cooked.

CREAM OF TOMATO

Ingredients: 2 tablespoonfuls of tomato juice, ½ cupful of milk, 1 tablespoonful of flour or bread-crumbs, 1 tablespoonful of butter, ¼ teaspoonful of salt, ⅛ teaspoonful of soda, a dash of pepper.

Method.—Heat tomato juice; add soda; heat milk; add butter, flour, salt, and pepper. When ready, serve at once with croutons or crackers.

CELERY BISQUE

Ingredients: 1 cupful of white sauce, 1 stalk of celery, 1 cupful of water.

Method.—Cut celery fine; cook in salted water until tender; mash fine; add white sauce; heat. Serve at once with bread sticks. A few oysters are a desirable addition.

CREAM OF SPINACH

Ingredients: 1 pint of spinach or 1 tablespoonful of spinach juice, 1 cupful of white sauce, ¼ teaspoonful of beef extract, ¼ teaspoonful of onion juice.

Method.—Pick over the spinach and wash thoroughly; place in stew pan and cook for fifteen minutes without cover, stirring occasionally; strain; heat white sauce; add extract and onion juice. Serve at once with wafers.

CROUTONS

Method.—Cut stale bread in 1 inch cubes, removing crust; melt 1 tablespoonful of butter in pan; add bread cubes; shake well; toast a golden brown in oven. May be prepared in quantities, as they will keep in a closed can indefinitely. Heat when used.

CONSOMMÉ WITH MACARONI

Ingredients: 1 cupful of consommé, 1 tablespoonful of cooked macaroni.

Method.—Heat consommé and macaroni. Serve hot with wafers.

VEGETABLE PURÉE

Ingredients: 1 ounce of suet or olive oil, 1 tablespoonful of chopped carrot, 1 tablespoonful of chopped turnip, 1 tablespoonful of celery, 1 tablespoonful of chopped potato, 1 thin slice of onion, 1 bay leaf, 1 cupful of white sauce, 1 tablespoonful of rice, 2 cupfuls of boiling water.

Method.—Place suet or oil in saucepan; when hot add vegetables and bay leaf; brown, stirring all the time; add well-washed rice and hot water; simmer slowly until vegetables are very tender; strain through purée strainer; add white sauce; bring to a boil. Serve at once with croutons.

PURÉE OF POTATO

Ingredients: 3 tablespoonfuls of hot mashed potato, 1 cupful of white sugar, ¼ teaspoonful of onion juice.

Method.—Heat white sauce; add mashed potato and onion juice; bring to a boil. Serve at once with bread sticks or crackers.

PEA PURÉE

Ingredients: 1 cupful of peas (fresh or canned), 1 cupful of white sauce, ¼ teaspoonful of sugar.

Method.—Cook peas until tender; if canned ones are used, drain and rinse off peas before adding fresh water to cook; press through strainer; add white sauce and sugar; bring to a boil. Serve at once with croutons or wafers.

CORN SOUP

Ingredients: ½ cupful of corn, 1 cupful of water, 1 cupful of white sauce, ¼ teaspoonful of onion juice, yelk of 1 egg.

Method.—Cook corn in water until tender; strain through strainer; add white sauce and onion juice; bring to a boil; pour over smoothly beaten yelk, stirring all the time. Serve at once with wafers.

BREAD STICKS

Method.—Cut bread in strips about 3 or 4 inches long and ½ inch square. Toast in oven a golden brown.

CREAM OF ASPARAGUS

Ingredients: 1 small bunch of asparagus, 1 cupful of white sauce, 1 cupful of white stock, ½ teaspoonful of onion juice, ⅛ teaspoonful each of salt and pepper.

Method.—Soak asparagus in cold salted water for one-half hour; drain; cut in small pieces; place in soup kettle; add stock; cook slowly until very tender; remove a few of the best tips before being boiled to pieces; strain through vegetable strainer; return to kettle; add white sauce, onion juice, salt, and pepper; bring to a boil. Serve with tips placed on top.

RICE SOUP

Ingredients: 2 tablespoonfuls of rice, 1 cupful of milk, 1 tablespoonful of butter, ½ teaspoonful of onion juice, ½ teaspoonful of celery, salt, a small bay leaf, dash of pepper.

Method.—Wash rice; put in double boiler, cook until very tender; add butter, onion juice, celery, salt, bay leaf, pepper; cook for fifteen minutes. If too thick, add hot milk and bring to a boil. Serve hot with bread sticks.

VICTORIA SOUP

Ingredients: 1 tablespoonful of minced chicken, ½ cupful of chicken broth, ½ cupful of milk, 1 tablespoonful of cracker crumbs, 1 hard-boiled egg, ½ teaspoonful of salt, a dash of pepper.

Method.—Soak crumbs in milk; mince chicken very fine; add to crumbs; add powdered yelk, salt, pepper, and broth; place all in double boiler and cook for one-half hour. Serve hot with croutons.

OYSTER SOUP

Ingredients: 1 cupful of oysters, 1 cupful of hot milk, 1 teaspoonful of butter, 1 teaspoonful of cracker crumbs, ½ teaspoonful of salt, ⅛ teaspoonful of pepper.

Method.—Wash oysters; place in saucepan with the liquor; bring to a boil; skim; add hot milk, butter, salt, pepper, cracker crumbs; bring to a boil. Serve at once, very hot, with oysterettes. Watch carefully, as the soup burns readily.

PURÉE OF CARROTS

Method.—Prepare sufficient red carrots to make 1½ cupfuls when sliced; parboil for ten minutes; drain and boil till tender in just sufficient water to keep from burning; season with salt and pepper; add 1 pint of beef or chicken broth or milk and 1 cupful of stale bread-crumbs; simmer for one-half hour and press through a purée sieve. If too soft, let cook a little longer; if too dry, add a little broth or milk. Serve with lamb chops or veal cutlets.

PURÉE OF LIMA BEANS

Method.—Soak 1 teacupful of lima beans over night; boil in water or stock or the thin part of a can of tomatoes until the beans are soft, using only enough fluid to keep from burning. Salt, pepper, a little onion juice, or any other seasoning preferred may be added; press through a sieve. Rub 2 teaspoonfuls of flour into the same amount of melted butter till the flour is smooth; pour slowly over this ½ cupful of boiling stock, stirring vigorously, and add this to the remainder of the soup; cut tomatoes into thin slices, or an equal amount of the solid part of canned tomatoes, and drop into the soup. Let it boil up once and serve.

CHAPTER L

TOAST, SANDWICHES, AND WAFERS

Lesson 5

White bread yields the highest amount of digestible nutriment, entire wheat ranks next, and Graham flour last.

The coarser flour with particles of bran acts as a stimulant to peristalsis.

Stale bread and dry toast are more easily digested than fresh bread.

All foods should be eaten slowly and thoroughly masticated, so that the saliva may be thoroughly mixed with the starch.

Bread for toasting should be cut in rather thin slices.

The object of toasting is to extract the moisture, improve the flavor, and increase the digestibility.

The addition of butter makes it more palatable and supplements it as a food by furnishing the fat, which the body needs. The toast should be evenly done and dried before browning.

Gluten is the principal nitrogenous ingredient of wheat. It has a high nutritive value and is easily digested. Gluten is flour from which the starch has been separated.

Make crackers crisp before serving by placing in a moderate oven for a few minutes.

All bread is much more appetizing if cut thinly and evenly, rather than rough and thick on one end and thin on the other.

Butter should be molded in balls or cut in cubes, never served in a slovenly manner.

The crust of toast should be removed or else rolled before buttering.

Care should be taken that toast is a golden brown, not burned on one end and white on the other, not soaked with melted butter, nor the butter dabbed on in patches.

BAKED TOAST

Method.—Prepare slices of stale bread by cutting off the crust and toasting to a light brown. Have ready a dish of boiling water well salted. Dip each slice into the salted water and then butter it; arrange in baking dish; cover with boiling milk, and bake for fifteen minutes. Add cream to the milk if it is available.

Water-toast may be made by omitting the milk, the toast being served between hot plates after being dipped in water and buttered.

CREAM-TOAST

Ingredients: 3 small slices of bread toasted, 1 teaspoonful of butter, 1 tablespoonful of cornstarch, 1 cupful of milk, ½ teaspoonful of salt.

Method.—Have the toast buttered; cut in small squares with crust rolled or removed; place it in hot deep basin or soup plate; let the milk come to a boil and add the butter; blend the cornstarch with a little water; stir it into the milk, and cook for five minutes in a double boiler, stirring until smooth. Pour over the toast, and serve at once.

MILK-TOAST

Method.—Toast 2 slices of bread evenly; cut in neat squares, removing the crust, and place in a deep basin, which should first be heated; have ready also a hot saucer or plate to cover it; prepare the tray with a small knife, fork, and teaspoon, a little silver pot of hot milk, a ball of butter, and a salt shaker. If the patient is able to butter his own toast and pour the hot milk, he will usually enjoy doing it. If not, the toast should be buttered, and the milk added when ready to be eaten. Bouillon or consommé may be used instead of milk.

CLAM-TOAST

Method.—Chop a dozen small clams into small pieces and simmer for a few minutes; beat the yelk of 1 egg with 2 tablespoonfuls of milk; pour it over the clams; let it come almost to the boiling-point, and pour over hot buttered toast. Lean ham may be minced, cooked, and served in the same way, a little butter and chopped parsley being used for seasoning.

TOMATO-TOAST

Method.—Peel and chop 1 ripe tomato; mince about 1 ounce of ham, a small onion, and cook all in about 1 tablespoonful of butter and a little water for about ten minutes. Stir into this a well-beaten egg; let it remain over the fire till it sets, and pour over hot toast.

MEAT SANDWICHES

Ingredients: $\frac{1}{4}$ cupful of minced chicken or cold meat of any kind, 1 tablespoonful of cream, 2 slices of bread buttered.

Method.—Butter bread before cutting; remove crust; cut in fancy shapes, as stars, triangles, etc., spread with mixture, and place together. Serve wrapped in napkin.

LETTUCE AND EGG SANDWICH

Ingredients: 1 hard-boiled egg yelk, 1 tablespoonful of cream, 1 tablespoonful of French dressing, lettuce leaves, 2 slices of bread, butter.

Method.—Cream yelk; add cream; prepare bread as above; spread with mixture; wash lettuce and add to bread. Serve, garnished with cress.

CELERY AND NUT SANDWICH

Ingredients: $\frac{1}{2}$ cupful of chopped celery, 3 stoned olives, 1 tablespoonful of minced English walnuts, 1 tablespoonful of dressing, 2 slices of bread, butter, and salt.

Method.—Chop ingredients fine; mix smooth with dressing; proceed as usual.

EGG SANDWICH

Ingredients: 1 hard-boiled egg, $\frac{1}{4}$ teaspoonful of salt, 1 tablespoonful of butter, $\frac{1}{8}$ teaspoonful of mustard, $\frac{1}{8}$ teaspoonful of vinegar, 2 slices of bread, butter, a few nasturtium leaves.

Method.—Mince the egg very fine; add other ingredients; mix well; prepare bread as usual; spread mixture on, then sprinkle with minced cress or nasturtium leaves; cover. Serve, garnished with nasturtium leaves, and blossoms.

SCRAPED BEEF SANDWICH

Ingredients: 1 tablespoonful of scraped raw beef, $\frac{1}{4}$ teaspoonful of salt, a dash of pepper, 2 slices of bread, butter.

Method.—Scrape beef with a dull knife; add salt and pepper; mix well, and proceed as usual; cut bread in strips; pile on plate log-cabin fashion. Serve, garnished with cress. Cover with doiley.

PLAIN BREAD AND BUTTER SANDWICH

Method.—Butter bread; cut thin; remove crust; cut in shape desired; may be toasted golden brown after making or may be varied by using brown bread for one side. Peanut butter may be used.

BROWN BREAD SANDWICH

Method.—Butter brown bread (baked in baking powder cans); cut thin; serve, garnished with cress or nasturtium leaves.

FRUIT SANDWICH

Method.—Butter bread as usual; then spread with minced figs, dates, prunes, mixed with a little lemon juice.

SHREDDED WHEAT SANDWICH

Method.—Cut biscuit in half; spread with apple-sauce or fresh berries or fruit of any kind. Serve with sweet or whipped cream.

NEW YORK SANDWICH

Method.—Butter 3 slices of bread (white), 2 of Graham; lay light, then dark, on top of one another alternately; press carefully together, then cut, like layer cake, in pieces ½ inch wide.

SOME SANDWICH FILLINGS

Equal parts of chicken and ham, finely minced, seasoned with curry powder. Minced tongue and hard-boiled egg, seasoned with mustard.

Minced hard-boiled egg, one sardine to every three, seasoned with lemon juice.

Water-cress, finely chopped, salt and pepper, and hard-boiled egg, chopped thoroughly.

Cold roast chicken and cold cooked oysters, chopped finely.

Cold corned beef and green peppers, minced finely.

MACAROONS

Ingredients: White of 1 egg, ⅜ cupful of almond powder.

Method.—Mix powder and unbeaten white (should be quite stiff); when well blended, drop ½ teaspoonful upon paper; do not butter paper; bake in moderate oven until a delicate brown; remove; turn upside down; moisten and remove paper.

BRAN CRACKERS

Ingredients: 1 cupful of bran, 1 cupful of flour, 3 tablespoonfuls of butter, ¼ teaspoonful of soda, ½ teaspoonful of cream of tartar, a dash of salt, ½ cupful of milk.

Method.—Mix bran, flour, cream of tartar, and salt; add butter and cream; add soda dissolved in milk; add milk enough to make a stiff dough; roll very thin; cut in squares; bake in slow oven. Will keep a long time in a tin box.

GUM GLUTEN WAFERS

Ingredients: ½ cupful of sweet milk, ¼ teaspoonful of salt, gum gluten, flavor.

Method.—Add salt to milk; then add enough gum gluten flour to make a stiff dough; roll very thin; cut into strips; bake in slow oven until a light brown.

GUM GLUTEN MUFFINS

Ingredients: 1 cupful of gum gluten flour, 1 cupful of milk, ½ teaspoonful of salt, ½ teaspoonful of baking powder, 1 egg.

Method.—Beat egg smooth, add to milk; add gum gluten flour, salt, and baking powder, sifted together; mix thoroughly; bake in gem pans in a moderate oven for about twenty minutes.

GUM GLUTEN BISCUITS

Ingredients: 1 cupful of gum gluten flour, 1 tablespoonful of butter, ½ teaspoonful of baking powder, ¼ teaspoonful of salt, about ½ cupful of milk, or enough to make a soft dough.

Method.—Mix dry ingredients; rub in the butter; add milk, enough to make a soft dough; roll about 1 inch thick; cut with biscuit cutter; bake in a quick oven for about fifteen minutes.

WHEAT WAFERS

Ingredients: 1 cupful of Vitos or cream of wheat, 2 tablespoonfuls of butter, ½ cupful of milk, 1 tablespoonful of sugar, ½ teaspoonful of salt, ½ teaspoonful of baking powder.

Method.—Cream sugar and butter; add milk, then dry ingredients; mix well; roll thin on floured board; cut in fancy shapes; bake in moderate oven until light brown.

OATMEAL WAFERS

Ingredients: ¼ cupful of rolled oats, ¼ cupful of fine oatmeal, ½ cupful of flour, 1 tablespoonful of sugar, 2 tablespoonfuls of butter, ¼ teaspoonful of salt, ½ teaspoonful of baking powder, hot water, or sour milk with ¼ teaspoonful of soda added, enough to make a stiff dough.

Method.—Mix dry ingredients; cream with the butter; add hot water to make a stiff dough; roll very thin on floured board; cut in strips; bake in moderate oven a golden brown.

OATMEAL TEA CAKES

Ingredients: 2 cupfuls of oatmeal, 1 cupful of flour, ½ cupful of sugar, ½ cupful of butter, 1 teaspoonful of baking powder, ½ teaspoonful of nutmeg, ½ cupful of milk, a dash of salt.

Method.—Mix dry ingredients; rub in the butter, add enough milk to make a stiff dough; roll very thin, cut in fancy shapes; bake in moderate oven a light brown.

PLAIN CAKE

Ingredients: ½ cupful of sugar, ½ cupful of milk, 1 tablespoonful of butter, ¾ cupful of flour, 1 teaspoonful of baking powder, ½ teaspoonful of flavoring, 1 egg, a dash of salt.

Method.—Cream butter and sugar; add well-beaten yelk, milk, and flavoring; flour and baking powder, sifted together; fold in stiffly beaten whites; place in buttered pan; bake in moderate oven for about one-half hour; or may be baked in layers and put together with whipped cream; or bake in gem pans and ice with plain or chocolate icing, with an almond on the top of each.

BROWN BREAD

Ingredients: ½ cupful of buttermilk, ¼ cupful of molasses, 1 cupful of Graham flour, ½ cupful of white flour, ½ teaspoonful of soda, a dash of pepper.

Method.—Dissolve soda in molasses; add buttermilk and flour of both kinds; beat well; place in well-buttered baking-powder cans; bake (covered) in a slow oven for about one hour. Serve either hot or cold.

CORNMEAL GEMS

Ingredients: 1 cupful of cornmeal, ½ cupful of flour, 1 tablespoonful of sugar, 1 tablespoonful of butter, 2 teaspoonfuls of baking powder, ¼ teaspoonful of salt, ¾ cupful of milk, ½ egg.

Method.—Sift dry ingredients together, rub in the butter; add milk and well-beaten egg; beat smooth; bake in shallow pan or in gem pans in a quick oven about one-half hour or until a golden brown. Serve hot, rolled in a napkin.

WHOLE WHEAT PUFFS

Ingredients: 1 egg, ½ cupful of sweet cream, 1 cupful of skimmed milk, 1 pint of flour.

Method.—Separate the white and yelk of the egg and beat the white to a stiff froth; beat the yelk, and add to it

½ cupful of thin sweet cream and 1 cupful of skimmed milk. Mix these together thoroughly until foamy with air bubbles. Then add, gradually beating at the same time, 1 pint of flour; continue to beat vigorously for ten minutes, then stir in lightly the stiff white. Do not beat after adding the white. Have the gem pans hot, fill each one, and bake. If rightly made, these are quite as light as bread made with yeast.

CHAPTER LI

MEATS AND FISH

Lesson 6

It is impossible to make a rich broth and have a juicy, highly flavored piece of boiled meat at the same time.

If the object is to cook by boiling, the meat should be placed in boiling water. This coagulates the albumin on the surface and a coating is formed.

Two conditions are essential to successful roasting—a good fire and frequent basting.

In boiling, the object is to coagulate as quickly as possible all the albumin on the surface and seal up the pores of the meat, so as to retain its juices and flavors.

By proper stewing the coarsest meat may be rendered tender and digestible.

The smaller the cut to be roasted, the hotter the fire should be for the first ten minutes.

The value of meat as a food depends not on the amount of nutriment contained, but the amount the individual patient can digest and assimilate.

ROAST CHICKEN

Method.—Clean and wash chicken; rub well with salt inside and out; stuff if desired; bake in covered roasting pan, with a little stock, about one hour for a young chicken; baste often; remove cover, and brown when tender.

CREAMED CHICKEN

Ingredients: 1 cupful of minced cold chicken, 1 cupful of white sauce, 1 slice of toast.

Method.—Mince chicken; add white sauce; heat; pour over toast. Serve on hot plate. Garnish with cress or parsley.

BROILED STEAK OR CHOPS

Ingredients: ½ pound of steak or chops, ¼ teaspoonful of salt, 1 teaspoonful of butter, a dash of pepper.

Method.—Remove all fat; wipe with damp cloth; broiling may be done over a clear fire of coals or gas; heat broiler; place meat on it; hold over the coals; count ten; turn without breaking the meat, continue turning and counting until done. If steak is 1 inch thick it should be done in eight to ten minutes. Place on hot plate; add butter, salt, and pepper. Garnish with parsley. Serve at once. All steak should be broiled; if impossible to use broiler, it may be pan-broiled. Have frying pan hot; place steak in, turn as if broiling in broiler. A little salt may be put in pan and browned before steak is put in, but in no case fat. The steak will not stick if the pan is clean and hot. It should be very hot when the meat is put in.

CHOPS BROILED IN PAPER CASES

Method.—Remove fat; wrap chop in buttered white paper and broil in broiler as usual (being careful not to ignite the paper); remove the paper; season. Serve on hot plate. Garnish with a spoonful of hot peas and parsley.

STEWED OR FRICASSEED CHICKEN

Ingredients: 1 chicken, 1 pint of milk, 1 teaspoonful of salt, 2 tablespoonfuls of flour, 1 tablespoonful of butter.

Method.—Clean, joint, and wash chicken; wipe dry; place in saucepan in which butter has been melted; brown slightly; add enough hot water to cover; bring to a boil; skim; simmer until tender, from one to two hours. Salt when half done; remove from pan and bring to a golden brown in oven if fricassee is desired. If simply stewed, add milk and flour made to paste with cold water. Serve on hot plate with toast.

CREAMED SALT CODFISH

Ingredients: ½ cupful of shredded codfish, 1 cupful of white sauce, yelk of 1 egg, 1 slice of toast.

Method.—Soak codfish in cold water for one or two hours; drain; place in saucepan with white sauce; heat;

remove from fire; add smoothly beaten yolk, stirring all the time. Serve over toast or in timbale cases. Garnish with parsley.

ROASTED PARTRIDGE OR QUAIL

Method.—Clean and bone (that is, remove first joint of leg). Place in cold salt water for one hour; wipe dry; stuff if desired; lard with a slice of bacon fastened on with cord or skewer; roast a golden brown in covered pan; remove bacon. Serve on hot plate in a bed of rice or cress with strips of toast. Any bird may be roasted in this way.

Birds may be broiled the same as steak or in paper cases. Split bird through the back; wipe dry; rub with softened butter, salt, and flour; broil for ten minutes. Serve on toast on hot plate. Garnish with parsley and currant jelly.

BACON

Method.—Cut very thin; fry crisp by commencing slowly and increasing the heat, or place pan on rack of moderate oven. Serve hot, drained of all fat.

CREAMED SWEETBREAD

Ingredients: 1 sweetbread, 1 cupful of white sauce.

Method.—Cover sweetbread with cold water for one hour; drain; remove fat and membranes; place in acidulated water; simmer slowly for twenty minutes; drain and plunge into cold water; remove at once; cut in ½-inch cubes; add white sauce; bring to a boil. Serve over toast. Garnish with parsley or cress.

Acidulated water: ½ tablespoonful of salt, 1 tablespoonful of vinegar, 1 pint of hot water.

ROAST BEEF OR MUTTON

Method.—Wipe roast with damp cloth, rub well with salt. The important point in roasting is the way you start. Have the fire hot at first, sear the roast on the cut ends by heating the pan hot, then place roast in and brown.

Then place in a roasting pan and roast in oven (covered), allowing fifteen to twenty minutes for each pound of meat.

Mutton does not need as hot a fire at first as beef.

FRIZZLED BEEF

Ingredients: $\frac{1}{8}$ pound of dried beef, 1 cupful of white sauce, 1 tablespoonful of butter, 1 slice of toast.

Method.—Mince beef fine; place in frying pan with butter; fry a golden brown; add white sauce; bring to a boil; pour over toast. Serve on hot plate at once or in timbale cases.

BAKED FISH

Ingredients: 1 fresh fish, 1 tablespoonful of bread-crumbs, 1 tablespoonful of butter, 1 teaspoonful of salt, $\frac{1}{2}$ cupful of stock, 1 slice of lemon, 2 slices of bacon.

Method.—Clean, wash, and remove head (see that all scales are removed); rub well outside and in with salt and butter. Stuff if desired. Lard with bacon; place in a well-buttered fish pan; sprinkle bread-crumbs over; add stock; bake (covered) for about one hour; baste often; remove cover and brown. Serve on hot plate. Garnish with shavings made from a long red carrot and a white turnip. Serve lemon with fish. Any fish may be baked in this way. White, shad, salmon, and pike are considered best for baking.

SCRAPED BEEF-BALLS

Method.—Scrape steak until all the soft part is removed; add salt; make into balls about the size of marbles; pan-broil as directed for pan-broiled steak for about two or three minutes. Serve on hot plate. Garnish with parsley.

MUTTON WITH OYSTERS

Ingredients: $\frac{1}{2}$ cupful of minced mutton, 1 tablespoonful of minced oysters, 1 tablespoonful of minced celery, $\frac{1}{2}$ cupful of stock, $\frac{1}{2}$ teaspoonful of onion juice, $\frac{1}{2}$ teaspoonful of

salt, 1 tablespoonful of butter, 1 tablespoonful of flour, a dash of pepper.

Method.—Mince mutton, removing all bone or gristle; cook celery till tender in a little water; drain; add mutton, oysters, stock, salt, onion juice, pepper; cream flour and butter; add to mixture; mix well; cook until it thickens, stirring all the time. Serve on hot plate. Garnish with toast points.

SALMON LOAF

Ingredients: ½ cupful of canned salmon, 1 tablespoonful of bread-crumbs, ½ cupful of milk, ½ teaspoonful of celery salt, 1 teaspoonful of lemon juice, 1 egg, a dash of pepper.

Method.—Drain fish; remove skin and bones; flake fine; add bread-crumbs, beaten yelk, milk, celery salt, lemon juice, pepper; mix well; fold in stiffly beaten white; pack in buttered cups; bake, covered (in a pan of water), for about fifteen minutes or until well risen. Remove cover and brown. Serve in bed of boiled rice or garnish with parsley, having bread sticks and a slice of lemon on side of plate.

PANNED OYSTERS

Ingredients: 1 cupful of oysters, 1 teaspoonful of butter, ½ teaspoonful of salt, a dash of pepper.

Method.—Wash oysters; drain; place in saucepan; heat until the oysters are plump; add butter, salt, pepper; pour over toast. Serve at once. Garnish with bread sticks piled in log-cabin fashion around the edge of the plate. Serve a slice of lemon with the oysters if desired.

FISH CAKES

Ingredients: 1 cupful of fish, ½ cupful of hot, mashed potato, 1 tablespoonful of butter, 1 tablespoonful of flour, ½ teaspoonful of salt, yelk of 1 egg.

Method.—Flake fish fine, removing all bones and skin; add potato, butter, salt, beaten yelk; mix well; make into

balls; roll in flour; brown in oven. Serve on hot plate. Garnish with parsley.

CREAMED COLD FISH

Ingredients: 1 cupful of flaked fish, 1 cupful of white sauce, 1 slice of toast, 1 slice of lemon.

Method.—Flake fish, removing bones and skin; add white sauce; heat, and pour over toast on a hot dish. Garnish with parsley and lemon.

SCALLOPED OYSTERS

Ingredients: 1 cupful of oysters, 1 cupful of cracker-crumbs, ½ cupful of milk, ½ cupful of oyster juice, 2 tablespoonfuls of butter, ⅛ teaspoonful of pepper, 1 teaspoonful of salt, yelk of 1 egg.

Method.—Drain and wash oysters; heat milk and oyster juice; moisten crumbs with heated mixture; spread a layer in buttered baking dish, then a layer of oysters; add salt, pepper, and bits of butter; then another layer of crumbs, continuing the process, having the last layer of crumbs; beat yelk of egg; add milk (1 tablespoonful); pour over top of pan; add bits of butter, and bake, covered, until well risen or about fifteen to twenty minutes; remove cover and brown. Serve in dish in which it is baked.

FRIED CHICKEN

Method.—Clean, wash, and joint chicken; wipe dry, rub well with salt; roll in flour; place in buttered pan; cook, covered, from ten to fifteen minutes or until tender; remove cover and brown; remove from pan; keep hot while you make gravy by rubbing 1 tablespoonful of flour in fat in pan until smooth; add 1 cupful of milk; stir until it thickens; pour over chicken. Serve on hot dish.

HAMBURG STEAK

Ingredients: ½ pound of Hamburg steak, ½ cupful of bread-crumbs, ½ teaspoonful of salt, ¼ teaspoonful of onion juice, ½ teaspoonful of parsley (minced), ½ cupful of stock.

Method.—Mix all the ingredients well together; make into balls, and pan-broil. Serve on hot plate; garnish with parsley.

BROILED HALIBUT

Ingredients: 1 slice of halibut, 1 slice of lemon, ½ teaspoonful of butter.

Method.—Wipe fish with damp cloth; rub well with salt and butter; place in buttered broiler; broil rather slowly, so as not to burn, for about ten minutes; place on hot plate and remove skin, add salt and bits of butter; garnish with parsley and lemon, or pour drawn-butter over fish, and serve at once, very hot.

BROILED SHAD

Method.—Split fish down back; remove large bone; rub with salt and olive oil or butter; broil as above, over moderate fire, for about twenty minutes. Serve on a hot plate. Garnish with a slice of lemon. Any large fish may be broiled in this way or may be larded with salt pork, and broiled in an oven.

CODFISH BALLS AND PARSLEY SAUCE

Ingredients: ½ cupful of shredded codfish, 1 tablespoonful of bread-crumbs, yelk of 1 egg.

Method.—Soak codfish for one-half hour in cold water; drain; add bread-crumbs and beaten egg; make into balls; place in buttered pan on rack of oven until golden brown. Serve on hot plate. Pour parsley sauce over all.

PARSLEY SAUCE

Ingredients: 1 cupful of stock, 1 tablespoonful of butter, 1 tablespoonful of browned flour, ½ teaspoonful of salt, 1 teaspoonful of minced parsley.

Method.—Cream butter and flour; heat stock; add to cream mixture; add salt and parsley; cook until it thickens.

CLAMS

Method.—Clams are usually served during the season when oysters are forbidden. Most of the directions for cooking oysters may be also used for clams. If desired to cook in a chafing-dish, the following is a good rule: Wash thoroughly one dozen large clams and plunge for a moment into boiling water. Drain off the water, open them, and use only the round plump part. Have ready in the chafing-dish 2 teaspoonfuls of butter, and when quite hot dust lightly with flour, salt, and pepper if desired. Drop the clams in and simmer for about four minutes. Pour over them 1 gill of light sherry, cover, and simmer slowly for five minutes. Serve on hot toast. Cream may be used instead of the sherry.

FROG'S LEGS

As a rule, the green marsh frogs furnish the best hams. Use only the hams. Pare off the feet and truss them by inserting the stump along the skin of the other leg. Wash and soak for one hour in water to which lemon juice, salt, and pepper have been added. Drain, roll in flour, then in beaten egg, and, lastly, in fine bread-crumbs. Fry in hot fat till they are a light brown and serve with fried parsley.

CHAPTER LII

VEGETABLES

Lesson 7

VEGETABLE foods are less easily digested and assimilated than animal foods. This is due to the fact that much of the nutritive material of vegetable foods is enclosed in cells with woody covering, which resist the action of the digestive juice and irritate the intestinal linings.

Beans are rich in nutriment, but are more easily digested when combined with other materials. They should be sparingly served to invalids.

The objects to be aimed at in cooking legumes are: to soften and separate the cell-fiber, so that the nutriment in close connection with it is freed.

To cook proteid matter so as to make it digestible and palatable.

To swell and burst the starch grains.

To combine with various other material and flavoring materials, so that the result is a palatable dish.

For invalids many vegetables are best served in the form of purées.

In cases where water has been condemned for drinking purposes, care should be taken that all fresh vegetables that are to be eaten uncooked are washed in water that has been boiled.

MASHED POTATOES

Method.—Boil till soft and drain. When dry, mash fine; add 1 tablespoonful of butter, ½ cupful of cream, ½ teaspoonful of salt, ⅛ teaspoonful of pepper for each pint of potatoes; beat until light and creamy; pile lightly in hot dish. Serve at once.

Riced potatoes are made by pressing mashed potatoes through a ricer. Serve on hot dish, pyramid shape.

SCALLOPED POTATOES

Ingredients: 1 cupful of sliced raw potatoes, 1 cupful of milk, 1 tablespoonful of butter, 2 tablespoonfuls of flour, 1 teaspoonful of salt, $\frac{1}{8}$ teaspoonful of pepper.

Method.—Place thinly sliced potatoes in well-buttered baking dish; sprinkle flour, salt, and butter over them; then another layer of potatoes. When full, pour milk over and bake, covered, until potatoes are tender (about one hour); remove cover, brown. Serve, garnished with cress.

POTATO ROSES

Ingredients: 1 cupful of mashed potatoes, 1 tablespoonful of butter, 1 egg.

Method.—Add butter and well-beaten egg to potatoes; press through pastry tube on buttered paper in shape of roses; bring to a golden brown in oven. Serve on hot plate, garnished with rings of red carrot and parsley.

POTATO SOUFFLE

Ingredients: 1 cupful of hot mashed potatoes, 2 tablespoonfuls of cream, 1 tablespoonful of butter, 1 egg.

Method.—Add well-beaten yelk of egg and cream to the potatoes; mix well; fold in stiffly beaten white; pile a mound lightly on buttered plate; place bits of butter over it; bake, covered, until well risen; remove cover and brown. Serve at once.

BAKED POTATOES (WHITE OR SWEET)

Method.—Select potatoes of uniform size; wash; clean; cut a small piece from the end, and bake in hot oven, keeping heat even, until tender (about one hour); pierce with hatpin to let gas escape. Serve at once, wrapped in a napkin, or remove one end and scoop out potato. Mash; add 1 teaspoonful of butter and cream, as in mashed potatoes. Return to shell and place in oven to brown, when you have potato surprise. Serve on hot plate. Garnish with parsley. Do not let baked potatoes stand; serve as soon as done.

BAKED HUBBARD SQUASH

Ingredients: ¼ hubbard squash, 1 tablespoonful of butter, 1 tablespoonful of cream, ½ teaspoonful of salt, a dash of pepper.

Method.—Wash squash; remove seeds; bake in a moderate oven until tender (about one-half hour); remove skin formed; scoop out pulp and mash fine; add butter, cream, and salt; beat lightly. Serve on hot dish, or it may be cut in strips and baked and served without removing from shell.

STEWED PEAS

Ingredients: 1 pint of fresh or 1 can of canned peas, ½ teaspoonful of sugar and salt, 1 teaspoonful of butter, a dash of pepper.

Method.—Shell; pick over peas; wash and cook in boiling water until tender (about one-half hour); add sugar, salt, pepper, butter, or drain water and add ½ cupful of milk, and the butter, sugar, salt, and pepper; heat to a boil and serve hot. If canned peas are used, drain all juice, and heat as directed.

CREAMED CARROTS

Ingredients: 1 small bunch of carrots, 1 cupful of white sauce.

Method.—Select young, smooth carrots; wash; scrape; cut in cubes; cook in boiling salt water until tender (about one hour); drain; chop fine; add white sauce; bring to a boil. Serve hot.

CREAMED CELERY

Ingredients: 3 or 4 stalks of celery, 1 cupful of white sauce.

Method.—Clean and cut celery into 1-inch pieces; cook until tender; drain; add white sauce; bring to a boil. Serve hot over toast.

STRING BEANS

Ingredients: ½ pint of beans, 1 cupful of white sauce.

Method.—String the beans, breaking in short lengths; wash; cook in boiling water until tender (about one-half hour); drain; add white sauce; heat. Serve hot.

CREAMED ASPARAGUS

Ingredients: 1 small bunch of asparagus, 1 cupful of white sauce, ½ teaspoonful of salt.

Method.—Soak asparagus in salt water for one-half hour; drain; cut in 1-inch lengths; cook in boiling salt water until tender (about one-half hour). The tips are more tender than the rest; watch, and remove before boiling to pieces; when tender, drain; add white sauce; bring to a boil. Serve, laying tips on top, or they may be served plain by adding 1 teaspoonful of butter; add salt and hot water after draining.

BAKED TOMATOES

Ingredients: Medium-sized tomatoes, bread-crumbs, salt, onion juice.

Method.—Wash tomatoes; remove some of the pulp; add pulp to other ingredients; mix well; fill cavity made in tomatoes with mixture; place in baking pan; add a little water; bake until tender (about one-half hour). Serve on hot dish with sauce remaining in pan.

SCALLOPED TOMATOES

Ingredients: 2 or 3 fresh tomatoes or 1 cupful of canned tomatoes, ½ cupful of bread-crumbs, 1 tablespoonful of butter, ¼ teaspoonful of salt, a dash of pepper, ½ cupful of stock or milk.

Method.—If fresh, wash, pare, and slice tomatoes, placing in layers in baking pan; season with salt, pepper, butter, then a layer of bread-crumbs, having the top layer of crumbs; place bits of butter over the top; pour stock

over and bake, covered, about twenty minutes; remove cover, and try if tomato is tender. Brown, and serve hot, garnished with cress.

STEWED TOMATOES

Ingredients: 1 cupful of tomatoes, ½ tablespoonful of butter, ¼ teaspoonful of salt, a dash of pepper, 1 tablespoonful of bread-crumbs.

Method.—Place ingredients in stew-pan, bring to a boil; cook about five minutes. Serve hot over toast in hot dish.

STEWED CORN

Ingredients: 1 cupful of corn, ½ cupful of white sauce, ¼ teaspoonful of sugar, 1 tablespoonful of egg.

Method.—Mix all ingredients except egg; cook until tender, (about fifteen minutes); remove from fire, add egg well beaten. Serve hot, or place after mixing in a baking dish. Sprinkle bread-crumbs over top and bake for twenty minutes in a moderate oven. Serve in dish in which it is baked.

LIMA BEANS

Ingredients: ½ cupful of lima beans, 1 tablespoonful of cream, 1 teaspoonful of butter, ½ teaspoonful of salt, ⅛ teaspoonful of soda.

Method.—If dried, soak lima beans over night in cold water, drain in morning; cook in boiling salt water for five minutes; add soda; bring to boil; drain; rinse; add hot water and cook until tender; drain; add cream, butter, salt, and bring to a boil. Serve hot.

STUFFED SQUASH

Ingredients: 1 small summer squash, 2 slices of stale bread, 1 tablespoonful of butter, 1 hard-boiled egg, 1 tablespoonful of nut meats, ½ teaspoonful of onion juice, ¼ teaspoonful of salt, a dash of pepper, 1 uncooked yelk of egg.

Method.—Wash and boil squash for fifteen minutes; remove; cut off top; take out seeds, and fill with force meat.

Method for Force Meat.—Cut bread in dice and brown; melt butter in pan; add browned bread and cool; add minced hard-boiled egg, onion juice, salt, and minced nut meats; mix well; add well-beaten yelk; fill cavity in squash; replace cover; bake until tender (about one-half hour). Serve whole on hot plate.

POTATO PYRAMID

Ingredients: 1 cupful of hot mashed potatoes, ½ cupful of milk, 1 egg, 1 tablespoonful of cracker-crumbs, 1 tablespoonful of butter, ½ teaspoonful of salt, a dash of pepper.

Method.—Add milk, butter, salt, and pepper to well-mashed potatoes; beat until light; add well-beaten yelk; mix well; fold in stiffly beaten white; pile in pyramid shape on well-buttered plate; make depressions in sides with point of knife; rub over with white of egg; sprinkle with cracker-crumbs; brown in oven. Serve hot, garnished with parsley.

PARSNIPS

Ingredients: 2 or 3 small parsnips, 1 tablespoonful of butter, 1 teaspoonful of sugar, ½ teaspoonful of salt.

Method.—Wash and scrape parsnips; cut in strips about 3 inches long, 1 inch thick; cook in boiling salt water until tender (about three-quarters of an hour); drain; place in buttered baking pan; sprinkle with butter, sugar, salt; add a little water; brown in oven. Serve very hot.

CREAMED CAULIFLOWER

Ingredients: 1 small cauliflower, 1 cupful of white sauce.

Method.—Break cauliflower in small pieces, being careful not to break the flower; let stand covered with salted water for one-half hour; drain; cook in boiling salt

water until tender (about one-half hour); drain; add white sauce; bring to a boil. Serve in hot dish.

RICE CROQUETTES

Ingredients: ½ cupful of rice, 1 pint of milk, 1 tablespoonful of chopped parsley, yelks of 2 eggs, salt, and pepper.

Method.—Wash the rice and cook in a double cooker till thoroughly soft; add the milk when the rice is about half-cooked; when cooked, take from the fire and beat till smooth, mashing all the grains; then add the well-beaten yelks of the eggs, the parsley, and seasoning, and cook ten minutes longer. Use white pepper if possible. Pour it out on a platter to cool, then form in pretty rolls, about 3 inches in length. Roll these in beaten eggs, then in bread-crumbs, and fry in boiling lard. Drain and serve with any meat cooked with gravy. May be served as a supper dish without meat.

BOILED RICE

Ingredients: 2 tablespoonfuls of rice, 1 pint of boiling water, ½ teaspoonful of salt.

Method.—Wash the rice and put into a double cooker with the boiling water; cook until the grains are quite soft; add as much water as needed to keep from sticking to the vessel while cooking; avoid stirring as much as possible; turn into a colander to drain, and then dry off for a few minutes in the oven. This may be eaten as a breakfast food or as a vegetable with any kind of meat which is cooked with a gravy. It combines well with any stewed meat. Rice may also be steamed over boiling water till quite soft, and served in the same way. The kernels, if possible, should be kept whole.

CHAPTER LIII

FRUITS AND DESSERTS

Lesson 8

The uses of fruits as food have been summed up as follows:

To furnish nutriment.

To convey water into the system, and relieve thirst.

To introduce various salts and organic acids, which improve the quality of the blood and react favorably upon the secretion.

As antiscorbutics.

As diuretics, and to lessen the acidity of the urine.

As laxatives.

To stimulate the appetite, improve digestion, and give variety to the diet.

The banana, date, fig, prune, and grape contain the most nutriment, which is largely in the form of sugar.

Fruits containing the most water are melons, oranges, lemons, limes, and grapes.

The best fruits for laxative purposes are apples, figs, prunes, peaches, and berries.

Dyspeptics should be cautioned against eating all hard-skinned or coarse-fibered fruits.

The substances chiefly used as desserts for invalids are milk, eggs, gelatin; the cereals, starchy foods, such as sago, tapioca, arrowroot, fruits, and fruit ices.

Milk taken in the form of junket or milk jelly, which is milk partly digested, may be served with a variety of flavors, and is one of the most valuable desserts for invalids.

Milk that has been boiled, sterilized, condensed, or evaporated should not be used for junkets.

Particular care should be taken to cook starchy foods thoroughly.

The time element in the preparation of desserts and

all foods should be carefully considered, so that the food may reach the patient in the best possible condition.

Always use the daintiest dishes procurable for serving.

LEMON ICE

Ingredients: ½ cupful of sugar, 1 cupful of water, ¼ cupful of lemon juice.

Method.—Make a syrup of the sugar and water, boiling about five minutes. Skim if necessary; cool; add lemon juice, strain, and freeze.

Orange ice is made by using oranges in place of the lemons, or any fruit juice may be used. Sherbet is made by adding the beaten white of egg or 1 teaspoonful of dissolved gelatin when half frozen. If only softly frozen it is called frappé; punch, if fruit is added.

PHILADELPHIA ICE-CREAM

Ingredients: 1 cupful of cream, 2 tablespoonfuls of sugar, ¼ teaspoonful of vanilla extract or one-quarter of a vanilla bean.

Method.—Place half of the cream in a double boiler; add sugar and vanilla; cook until sugar is dissolved, stirring constantly; strain and cool; add the rest of cream and freeze. Any flavoring may be used. If the fruit cream is desired, use the same amount of fruit as cream, and proceed as above.

FROZEN CUSTARD

Ingredients: 1 cupful of milk, 1 tablespoonful of sugar, yelks of 2 eggs, ¼ teaspoonful of vanilla, a pinch of salt, 1 teaspoonful of cornstarch.

Method.—Place milk in double boiler; add sugar and cornstarch, well mixed; stir until it begins to thicken; remove from fire; add flavoring and well-beaten egg; stir until mixed; strain, cool, and freeze. These two rules are the foundation for all ice-cream. Add fruit and it is called tutti frutti; nuts, and it is called pistachio.

Coffee may be used in place of half of the milk. Different flavors give the name to the cream.

CHARLOTTE RUSSE

Ingredients: 1 cupful of cream, 1 tablespoonful of sugar, ¼ teaspoonful of vanilla, ½ dozen lady fingers, 1 tablespoonful of granulated gelatin, white of 1 egg, ½ cupful of water.

Method.—Dissolve gelatin in water; whip cream after adding sugar and flavoring; when stiff, add stiffly beaten white of egg and gelatin, and beat well; line with lady fingers; pour mixture in center; set in cold place.

BAVARIAN CREAM

Ingredients: 1 tablespoonful of grated chocolate, 1 cupful of milk, 1 tablespoonful of sugar, 1 tablespoonful of granulated gelatin, 2 tablespoonfuls of cold water, ½ pint of whipped cream, ½ teaspoonful of vanilla.

Method.—Dissolve chocolate; place milk in double boiler; add chocolate and sugar; heat to boiling-point; remove from fire; add extract; pour over dissolved gelatin; set in cold place until it hardens; then fold in whipped cream; pour in mold; set in cold place until firm. Serve very cold. Any fruit juice desired may be used in place of chocolate.

A pretty way to serve ice-cream is to bake angel cake in cups. When cold, remove the inside; make handles of spaghetti, softened in hot water, formed in loops, and dried; stick in sides of cake, making a basket; fill with cream; place a candied cherry on top. Serve on cold plate. Garnish with rose leaves and buds.

STRAWBERRY BLANC MANGE

Ingredients: 1 cupful of milk, 1 teaspoonful of cornstarch, 1 tablespoonful of sugar, ½ teaspoonful of flavoring, 1 egg, 1 cupful of berries (fresh are best).

Method.—Heat milk in double boiler; add cornstarch and sugar, well mixed; stir until it thickens; remove

from fire; add well-beaten egg and flavoring, stirring until well mixed; pour in border molds; set in cold place until firm; turn out on cold plate; fill center with the well-washed berries. Serve cold with whipped cream or boiled custard. Flavoring with chocolate or filling the center with bananas make agreeable changes.

ORANGE PUDDING

Slice a sweet orange thin after peeling; remove seeds; cover with sugar. Pour boiled custard over orange; make a meringue; place over all; set in oven until firm (about two minutes). Serve cold.

Do not let the orange heat, as it will become bitter.

LEMON JELLY AND SNOW PUDDING

Ingredients: 2 tablespoonfuls of granulated gelatin, 2 tablespoonfuls of cold water, 1 tablespoonful of sugar, 1 tablespoonful of lemon juice, 1 cupful of hot water.

Method.—Soak gelatin in cold water five minutes; add boiling water, stirring all the time; add sugar and lemon juice; pour in mold; set in cold place until firm. By adding the stiffly beaten white of an egg just as it begins to harden, beating until stiff and white, it makes what is called snow pudding. Put on ice. Serve on cold dishes with whipped cream or custard.

TAPIOCA CREAM

Ingredients: 1 teaspoonful of pearl tapioca, 1 cupful of milk, 1 tablespoonful of sugar, 1 egg, $\frac{1}{8}$ teaspoonful of salt, $\frac{1}{4}$ teaspoonful of flavoring.

Method.—Wash and soak tapioca in cold water over night; drain; place in double boiler; add milk, sugar, and salt; cook until it thickens; remove from fire; add flavoring and well-beaten egg yelk; turn into serving dish; cover with a meringue made of the stiffly beaten white; place in oven until golden brown. May be served either cold or hot. A few chopped dates may be added when desired.

BANANA CREAM

Ingredients: 1 banana, ½ cupful of cream, 1 teaspoonful of sugar, 1 teaspoonful of gelatin, a few drops of vanilla.

Method.—Peel and mash banana; dissolve gelatin in cold water; add mashed banana, sugar, cream, and vanilla; mix well; add dissolved gelatin; turn into mold; set in cold place until firm. Serve cold with sponge cake.

COTTAGE PUDDING

Ingredients: ½ cupful of sugar, ¼ cupful of milk, ¼ cupful of butter, 1½ cupfuls of flour, 1 egg, 1 teaspoonful of baking powder, ½ teaspoonful of flavoring or ½ teaspoonful of grated nutmeg.

Method.—Cream sugar and butter; add well-beaten egg and milk, then flavoring and flour, with baking powder sifted together; place in buttered pan; bake in moderate oven about one-half hour or until done; cut in squares. Serve with lemon sauce.

APPLE TAPIOCA

Ingredients: 1 tart apple, 1 tablespoonful of sugar, 1 cupful of water, 1 tablespoonful of pearl tapioca, salt, nutmeg or cinnamon.

Method.—Soak tapioca for three hours in cold water; pare and core apple; place in pudding pan; fill cavity with sugar; add tapioca; add salt and water; grate nutmeg over; bake about one hour or until apple is tender and tapioca clear. Serve either hot or cold, with cream and sugar.

CREAMED RICE WITH STRAWBERRIES

Ingredients: 1 tablespoonful of rice, 1 cupful of milk, 1 cupful of berries, 2 tablespoonfuls of sugar, 1 cupful of whipped cream, 1 teaspoonful of gelatin.

Method.—Wash rice; place in double boiler; add milk; cook until tender; add sugar; soak gelatin in cold water ten minutes, and add to rice, stirring until well mixed.

When cold, fold in whipped cream; pour in border mold; set in cold place until firm; turn out on cold plate; fill center with well-washed and hulled berries, saving some of the best with their caps to garnish the plate.

GELATIN FRUIT PUDDING

To a plain lemon jelly, when beginning to set, add sliced fruit, as oranges, pineapples, peaches, bananas, white grapes, strawberries. Or the fruit may be placed in layers and the gelatin poured over and left to set, and then another layer of fruit added. Set in cold place until firm. Serve cold with cream or soft custard.

SPANISH CREAM

Ingredients: 1 tablespoonful of granulated gelatin, 2 tablespoonfuls of cold water, 1 cupful of milk, 2 tablespoonfuls of sugar, ½ teaspoonful of vanilla, 2 eggs, ⅛ teaspoonful of soda.

Method.—Soak gelatin five minutes in cold water; heat the milk; add soda, sugar, and beaten yelks; stir until it thickens; pour over gelatin; stir until cold; add stiffly beaten whites and vanilla; pour over sliced fruit, as bananas, oranges, fresh berries; set in cold place until firm. Serve cold with whipped cream or boiled custard.

RICE PUDDING

Ingredients: ½ cupful of rice, 1 tablespoonful of sugar, 1 pint of milk, ½ teaspoonful of flavoring.

Method.—Wash rice; add sugar, salt, milk, and flavoring; bake, covered, until it thickens and rice is tender (about one hour); stir often. A few raisins may be added. Serve either hot or cold with cream and sugar.

FRENCH BREAD PUDDING

Ingredients: ½ cupful of bread-crumbs, 1 cupful of milk, 1 tablespoonful of sugar, ¼ teaspoonful of salt, ⅛ teaspoonful of soda, 1 egg, ¼ teaspoonful of nutmeg.

Method.—Mix bread-crumbs, sugar, salt; add milk in which soda has been dissolved; add well-beaten egg and nutmeg; place in baking pan, bake, covered, about one-half hour or until firm. Serve hot with lemon sauce or cream and sugar.

GRAHAM PUDDING

Ingredients: ½ cupful of molasses, ¼ cupful of butter, ¼ cupful of sour milk, ½ cupful of chopped raisins, 2 cupfuls of Graham flour, ½ teaspoonful of soda, ½ teaspoonful each of cinnamon, cloves, and nutmeg, 1 egg.

Method.—Dissolve soda in molasses; add milk, butter, spices, beaten egg; mix well; wash and stone raisins; mince; cover with flour; add to mixture with flour; place in well-buttered pudding pan, and steam three hours. Serve hot with lemon juice.

RICE AND APPLE SOUFFLE

Ingredients: 1 tablespoonful of rice, 1 cupful of milk, 1 tart apple, 1 egg, 1 tablespoonful of sugar.

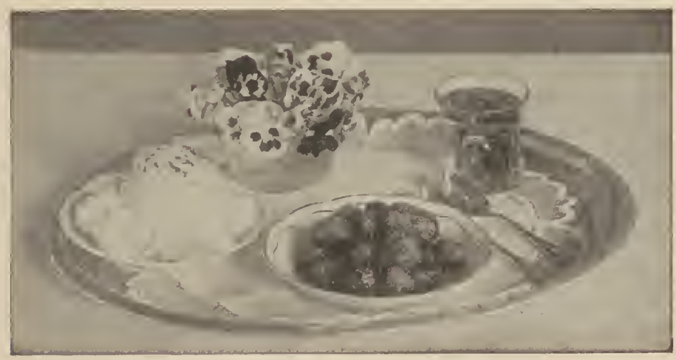
Method.—Wash rice; cook in double boiler until tender; add well-beaten yelk and sugar; place in border mold; pare and core apple; cook until tender. When rice is firm, turn on cold plate, place apple in center, and fill core cavity with jelly; cover all with stiffly beaten whites; place in oven until a golden brown. Serve with cream and sugar.

ARROWROOT BLANC MANGE

Ingredients: 1 cupful of milk, 2 tablespoonfuls of arrowroot, 2 teaspoonfuls of sugar, ¼ teaspoonful of vanilla, 1 pinch of salt.

Method.—Place milk in double boiler; heat; add arrowroot and sugar mixed to a paste with cold water; stir until it thickens; remove from fire; add salt and flavoring; pour in mold; set in cold place until firm. Serve cold with whipped cream. Garnish with candied cherries. Lady fingers may be served with it.

Bouillon and arrowroot blanc mange.



Strawberries and a cream puff.

Calf's foot jelly and other things.

FLOATING ISLAND

Ingredients: 1 cupful of milk, 1 tablespoonful of sugar, $\frac{1}{8}$ teaspoonful of flavoring, a dash of salt, 1 teaspoonful of powdered sugar, 1 egg, $\frac{1}{4}$ teaspoonful of cornstarch.

Method for the Custard.—Heat the milk in double boiler; add sugar and salt; take from fire; add well-beaten egg yelk; stir until it thickens; add flavoring; turn into a glass dish and set in cold place.

Method for the Island.—Beat white of egg till very stiff; add powdered sugar; drop islands (about $\frac{1}{2}$ teaspoonful) on buttered paper; place in oven for a minute; then place on top of custard.

FRUIT SOUFFLE.

Ingredients: 1 cupful of stewed fruit, $\frac{1}{4}$ cupful of sugar, white of 1 egg, $\frac{1}{4}$ teaspoonful of flavoring.

Method.—Cook fruit until very tender; strain through coarse strainer; add sugar and flavoring; cool; then fold in stiffly beaten white; set in cold place; serve cold. Any fruit may be used, either dried or fresh—apples, peaches, prunes, apricots, berries.

IMPERIAL CREAM

Make a plain lemon jelly; divide in thirds; color one-third pink and turn into square mold; mold the plain lemon jelly in a square mold; make a snow pudding of the other third. When nearly ready to harden, drop lemon and pink jelly, cut in inch cubes, into snow pudding; place in mold; set in cold place. Serve on cold dish. Garnish with macaroons. Pour boiled custard over, and serve.

PRUNE SPONGE

Ingredients: Juice of 1 lemon, $\frac{1}{4}$ cupful of sugar, 2 eggs, 1 tablespoonful of gelatin, 1 cupful of water, 1 cupful of jellied prunes.

Method.—Heat juice of lemon; add sugar; stir until

dissolved; add well-beaten yelks; stir until thick; pour over dissolved gelatin; fold in stiffly beaten whites; pour into border molds; set in cold place until firm; turn on cold dish; fill center with jellied prunes. Serve with whipped cream.

JELLIED PRUNES

Ingredients: ½ cupful of dried prunes, ¼ cupful of sugar, 1 cupful of water.

Method.—Wash prunes very thoroughly; soak over night; cook on back of stove where they will not boil until tender; remove stones and drop into hot syrup; bring to a boil; set aside until wanted. Use as directed above.

PRUNE WHIP

Ingredients: 1 cupful of cooked prunes, white of 1 egg, 1 tablespoonful of sugar, 1 tablespoonful of lemon juice.

Method.—Strain prunes through coarse sieve, removing stones; add lemon juice; fold in stiffly beaten white; add sugar; pile on buttered plate; stand in oven for about one minute or until set. Serve cold with whipped cream or thin boiled custard.

CRACKER PUDDING

Ingredients: 2 soda crackers, 1 cupful of milk, 2 tablespoonfuls of sugar, a dash of salt, ½ teaspoonful of flavoring, 1 egg, 1 tablespoonful of butter.

Method.—Roll crackers; add milk, sugar, salt, beaten yelk, flavoring, and butter; mix well; place in buttered pudding dish; bake about fifteen minutes, or until when a knife is run in it is clear on removing; place a meringue on top; set in oven until a golden brown. Serve hot with currant jelly on top.

GRAPE FLUFF

Ingredients: 1 tablespoonful of granulated gelatin, ¼ cupful of cold water, ½ cupful of sugar, 1 cupful of grape juice, juice of 1 lemon, whites of 3 eggs.

Method.—Soak gelatin in cold water five minutes; dissolve by standing over steam; add sugar to grape juice; stir until dissolved; add gelatin and lemon juice; mix well; stand in cold place until it begins to thicken, then add stiffly beaten whites; beat until light and stiff. Serve cold with whipped cream.

RHUBARB BLANC MANGE

Ingredients: 1 cupful of strained rhubarb juice, ½ teaspoonful of vanilla, 1 teaspoonful of lemon juice, ½ cupful of sugar, 2 tablespoonfuls of cornstarch, ⅛ teaspoonful of soda.

Method.—Wash and stew rhubarb without peeling; strain; measure juice; add soda, then sugar; return to fire; add cornstarch made into a paste with cold water; cook until clear and thick; remove from fire; add flavoring; pour in mold; set in cold place until firm. Serve with cream and sugar.

APPLE CHARLOTTE

Ingredients: 1 cupful of bread-crumbs, ½ cupful of sliced apples (tart), 2 tablespoonfuls of sugar, 2 tablespoonfuls of butter, 1 teaspoonful of cinnamon or nutmeg, a little salt, hot water or milk.

Method.—Moisten bread-crumbs; place a layer in buttered pudding pan; then a layer of apples; sprinkle with sugar and spice; add bits of butter; continue until pan is full, having the top layer of crumbs; pour milk or water over until covered, bake (covered) about one hour or until apples are tender. Remove cover and brown. Serve hot with hard sauce or cream and sugar.

BAKED BANANA

Peel and cut banana in half; place in a shallow pan; sprinkle with sugar, a little lemon juice, and water; bake under cover until soft and light brown (about twenty minutes).

DATE BONBONS

Wash dates; remove seeds; fill cavity with chopped salted almonds or peanuts; close cavity; roll in powdered sugar.

GRAPEFRUIT

Cut in half, crosswise; separate pulp from skin, then make cuts separating pulp from tough portion; remove tough part; sprinkle with sugar; let stand in cold place ten minutes. Serve, garnished with a few candied cherries.

BANANA CUSTARD

Make a rich, soft custard with yelk of egg, milk, and cornstarch, using any flavoring desired; peel a banana, cut in thin slices, and line the bottom and sides of the glass dish in which the custard is to be served; beat the white of the egg to a stiff froth; drop in molds on top of the custard; put in oven for a moment to set the white, and serve cold. If desired, the bananas may be moistened with lemon juice.

RICE CREAM

Ingredients: 1 pint of rich milk (or thin cream if obtainable), 1 egg, 2 tablespoonfuls of sugar, ½ ounce of gelatin, ½ cupful of cold, boiled rice.

Method.—Out of the milk, egg, and sugar make a smooth custard; dissolve the gelatin in cold water and add to the custard, then stir in the boiled rice; flavor with vanilla; turn into a jelly mold until it is set. Serve with whipped cream.

APPLE SNOW

Put a cupful of fresh apple-sauce through a colander to remove any stringy portions; sweeten and flavor to taste; whip ½ cupful of sweet cream and the white of an egg separately, then together, and add the apple; pour into mold, and set on ice until needed.

CHAPTER LIV

SALADS

Lesson 9

A SALAD is composed of two parts—the body and the dressing.

Salads may be used as a means of furnishing nutriment, to stimulate the appetite, improve digestion, and give variety to the diet.

Salads may be a combination of fish, meat, chicken, with appropriate vegetables, or may be made wholly from vegetables, or may be a combination of fruits with gelatin.

All materials used in salads should be in first class condition.

With the exception of onions and parsley, ingredients for salads should be cut, never chopped; everything should be thoroughly cold before mixing.

A salad of fish, vegetables, or chicken may appropriately take the place of meat at dinner in hot weather.

Bean salad is one of the most nutritious of the vegetable salads.

Fruit salads should be served thoroughly chilled. They are used as a delicacy to give variety at the beginning of the meal, or may be used as a dessert.

The tempting quality of any salad, and especially of fruit salads, is much enhanced by the way it is served.

Use small, dainty dishes, sherbet cups, or small fruit cups. Set the fruit cups on a plate surrounded by rose leaves, or green leaves and buds.

A dainty vegetable or meat salad, with the addition of crisp small crackers, makes a tempting luncheon for convalescents.

In making salads toss the ingredients with a fork rather than stir with a spoon.

RIBBON SALAD

Ingredients: ½ cupful of cold string beans, ½ cupful of celery, ½ cupful of cold peas, 2 or 3 lettuce leaves, 1 red radish, ½ teaspoonful of onion juice, French dressing.

Method.—Cut beans and celery in inch lengths; mix each separately with dressing; add onion juice to beans; arrange lettuce leaves on salad plate; arrange vegetables in layers on lettuce, having celery in the center; pour a spoonful of dressing on top; garnish with radish cut in rounds.

WILTON SALAD

Ingredients: 1 boiled beet, ½ cupful of celery, 1 hard-boiled egg, French dressing.

Method.—Cut beets in fancy shape; celery in cubes; egg in slices; mix altogether; add dressing. Serve on salad plate; garnish with parsley.

FISH SALAD

Ingredients: ½ cupful of flaked fish, ½ cupful of shredded celery, 1 teaspoonful of minced parsley, French dressing.

Method.—Mix each ingredient with dressing and combine. Serve arranged on lettuce leaves on salad plate; garnish with sliced lemon.

EGG SALAD OR STUFFED EGG

Ingredients: 1 hard-boiled egg, 1 teaspoonful of minced chicken, ¼ teaspoonful of salt, 1 teaspoonful of cream, a dash of pepper, Mayonnaise dressing.

Method.—Cut egg in half lengthwise, being careful not to break the white; cream the yelk; add chicken, salt, cream, pepper; mix well; fill cavity in white with mixture; place on bed of parsley; pour dressing over all. Serve with bread and butter sandwiches.

CHICKEN SALAD

Ingredients: 1 cupful of minced chicken, 1 cupful of minced celery, Mayonnaise dressing.

Method.—Mix chicken and celery; add dressing; arrange on lettuce leaf; one-half cupful of minced nuts may be added. This makes a very rich salad.

MACEDOINE SALAD

Ingredients: ½ cupful each of peas, beets, carrots, potatoes, string beans, celery, and asparagus, French dressing.

Method.—Cook all but the celery till soft, then cut in cubes or fancy shapes; mix each with dressing; arrange on lettuce leaf, in layers of contrasting colors; garnish with celery tips.

FRUIT SALAD

Ingredients: 1 banana, 1 orange, 1 cupful of diced pineapple, 1 cupful of minced celery, 1 cupful of minced English walnuts, a few candied cherries, French dressing.

Method.—Remove skin of banana carefully, making a boat to use to serve the salad in; halve the orange; remove pulp without breaking skin, making bowls for serving; cut banana, celery, and orange in fancy shapes; mix all the fruit separately with the dressing; keep cold; blanch and mince nuts; mix with dressing; combine, and fill banana boat and orange shells; arrange on salad plate in bed of lettuce or parsley; place cherries on top. Serve sponge cake or lady fingers with salad.

BIRD-NEST SALAD

Ingredients: 1 cupful of cottage cheese, 1 hard-boiled egg; French dressing.

Method.—Mold cheese in balls the size of marbles; chop egg fine; add to part of cheese before molding, or color part of cheese with spinach juice and add to plain cheese before molding; arrange on the lettuce leaf; pour dressing over.

POTATO SALAD

Ingredients: 1 cupful of potatoes, ½ cupful of minced celery, 1 teaspoonful of minced parsley, ½ teaspoonful of onion juice, French dressing.

Method.—Cut potatoes into fancy shapes, using them while hot; cut celery into cubes; mix each with dressing; then combine and serve on lettuce leaf; garnish with hard-boiled egg or red beets or radish, cut into rounds.

BEET AND EGG SALAD

Ingredients: 1 cupful of cooked red beets, 2 hard-boiled eggs, French dressing.

Method.—Cut beets in fancy shapes; slice eggs; mix with dressing; arrange on lettuce leaf. Serve with meats.

WALDORF SALAD

Ingredients: 1 cupful of raw apple, 1 cupful of celery, ½ cupful of nut meat, French dressing.

Method.—Peel and cut an apple into dice; cut celery into cubes; blanch and mince nuts; mix all separately with the dressing; arrange on lettuce leaf, or remove top and pulp of apple, so as to save the skin for a cup to hold the mixture. Serve on salad plate; garnish with lettuce or parsley.

TOMATO SALAD

Ingredients: 1 smooth tomato, 1 teaspoonful of minced onion or onion juice, Mayonnaise dressing.

Method.—Peel the tomato carefully; remove top and pulp; mince pulp; add minced onion and dressing; refill tomato case; put a spoonful of dressing over and place on lettuce leaf. Serve with meats.

ASPARAGUS AND SALMON SALAD

Ingredients: 1 cupful of flaked salmon, ½ cupful of asparagus tips, ½ cupful of celery, Mayonnaise dressing.

Method.—Flake the salmon, removing bones and skin; cut asparagus and celery into inch pieces; mix each with dressing and combine. Serve on lettuce leaf.

BEAN SALAD

Ingredients: 1 cupful of beans, 1 tablespoonful of minced white onion, 1 tablespoonful of tomato sauce, 1 tablespoonful of mustard dressing (Heinz).

Method.—Mix ingredients well, being careful not to break the beans. Serve on lettuce leaf. Very good for luncheon.

LEMON DRESSING

Very nice when patient cannot have vinegar. Juice of 1 lemon; as much cold water; $\frac{1}{4}$ teaspoonful of salt; 1 teaspoonful of sugar; mix well.

CREAM DRESSING

Ingredients: 2 eggs, 2 tablespoonfuls of butter, 2 tablespoonfuls of vinegar, 2 tablespoonfuls of water.

Method.—Beat eggs slightly; place water and vinegar in double boiler; add butter, heat, and add eggs slowly; do not boil, but stir until it is thick as cream; remove from fire, and add salt. Be very careful not to curdle.

BANANA SALAD

Peel and split bananas; roll in chopped nuts and place on crisp lettuce leaf. Just before serving, place a spoonful of cream dressing over. Serve with small cakes.

MIXED FRUIT SALAD

Three or more kinds of fruit may be used, raw or canned; place fruit in layers, sprinkling each with sugar; pour cream dressing over; let stand to set; before serving, sprinkle thickly with cocoanut. Peaches, oranges, pineapple, banana, etc., may be used.

ORANGE SALAD

Peel large sweet orange, and cut in thin round slices; place a layer in the bottom of the dish, cover with Mayonnaise dressing, and continue to alternate the layers,

finishing with the sliced oranges. This is a quickly prepared, simple relish when greens or other salads are not available.

COTTAGE-CHEESE SALAD

Ingredients: 1 cupful of cottage cheese, ½ cupful of chopped celery, ½ cupful of French dressing or cooked Mayonnaise, 1 hard-boiled egg, 4 walnuts.

Method.—Prepare the cheese and drain thoroughly; arrange the cheese in the dish in which it will be served on lettuce leaves or cress, and alternate layers of finely chopped celery, the walnut meat, and a thin slice of hard-boiled egg.

CHAPTER LV

MISCELLANEOUS FOODS

Lesson 10

MINT SAUCE

Ingredients: 2 tablespoonfuls of minced green mint, 2 tablespoonfuls of sugar, ½ cupful of vinegar.

Method.—Mince mint very fine; add sugar and vinegar; place in wide-mouthed bottle; shake well; let stand twenty-four hours, then it is ready to serve after shaking.

EGG SAUCE

Ingredients: 2 tablespoonfuls of butter, 1 tablespoonful of flour, ¼ teaspoonful of salt, ½ cupful of hot water 2 eggs, a dash of pepper.

Method.—Blend butter, flour, salt, pepper; add water; boil five minutes; remove from fire; add well-beaten egg, stirring all the time; boil 1 egg twenty minutes; when cold, slice and add to sauce. Serve with fish.

TOMATO SAUCE

Ingredients: ½ cupful of tomato juice, ¼ cupful of water, 3 whole cloves, 1 whole allspice, ½ teaspoonful of mixed herbs, ⅛ teaspoonful of onion juice, 1 teaspoonful of butter, 1 tablespoonful of flour, ¼ teaspoonful of salt, a dash of pepper.

Method.—Place tomato juice, water, and spices in saucepan; cook for five minutes; strain; return to fire; add flour and butter well blended; stir until it thickens; may be kept until needed.

LEMON SAUCE

Ingredients: 1 cupful of hot water, ½ cupful of sugar, 1 tablespoonful of flour, 1 tablespoonful of butter, 1 tablespoonful of lemon juice.

Method.—Mix flour and sugar, add water slowly, stirring all the time; cook until it thickens; remove from the fire; add butter. Lemon juice or any flavoring desired may be used.

HARD SAUCE

Ingredients: 3 tablespoonfuls of butter, 6 tablespoonfuls of sugar, ½ of white of 1 egg, ½ tablespoonful of cream, nutmeg.

Method.—Cream butter and sugar. When light and creamy, add unbeaten egg and the cream, a little at a time; heap on dish; grate nutmeg over all; put in cold place until needed.

ANOTHER HARD SAUCE

Beat ¼ pound of butter to a cream; add gradually 1 cupful of powdered sugar; add 4 tablespoonfuls of boiling water, one at a time. Beat for five minutes, add the white of 1 egg and 1 teaspoonful of vanilla. Put mixture at once into the serving dish and set in cold place.

BROWN SAUCE

Ingredients: 2 tablespoonfuls of brown flour, 2 tablespoonfuls of butter, 1 cupful of stock, ¼ teaspoonful of salt, a dash of pepper.

Method.—Brown flour by placing in hot frying pan and stirring until a golden brown; add butter, salt, pepper; mix well; add stock; stir over fire until thickened. By adding 1 tablespoonful of minced parsley, we have parsley sauce.

LEMON SYRUP

Ingredients: 5 lemons, 8 pounds of sugar, 3 ounces of citric acid, 3 quarts of water.

Method.—Wash lemons; roll until soft; remove seeds and juice; add to the water and sugar; boil fifteen minutes. Half of the skin may be boiled with it; be sure all seeds are removed. Strain in a jar; add citric acid while hot; stir until dissolved; let stand twenty-four hours; bottle and keep in a cold place; 1 tablespoonful of syrup to a glass of water makes a delicious lemonade.

MADE MUSTARD

Ingredients: 2 tablespoonfuls of dry mustard, 1 tablespoonful of flour, ½ cupful of vinegar, ½ cupful of water, 1 teaspoonful of sugar, ¼ teaspoonful of salt.

Method.—Mix dry ingredients; heat water and vinegar; add slowly to dry ingredients, stirring all the time; cook until it thickens.

SPONGE CAKE

Ingredients: ½ cupful of powdered sugar, ½ cupful of flour, a dash of salt, ½ teaspoonful of flavoring, 3 eggs, ½ teaspoonful of baking powder.

Method.—Beat yelks smooth; add to the sugar; mix well; add flour, baking powder, and salt, sifted together; beat well; add flavoring; fold in stiffly beaten whites; bake in a moderate oven in gem pans until a straw comes out clean.

HOT-WATER SPONGE CAKE

Ingredients: ½ cupful of powdered sugar, ½ cupful of flour, ¼ cupful of boiling water, ½ teaspoonful of baking powder, a dash of salt, ½ teaspoonful of flavoring, 2 eggs.

Method.—Beat yelks smoothly; cream sugar well into yelks; add flour, baking powder, and salt, sifted together; beat well; add boiling water carefully, a little at a time, stirring all the time; add flavoring; fold in stiffly beaten whites; bake in well-buttered pan, in moderate oven, about one-half hour.

GINGERBREAD

Ingredients: ½ cupful of brown sugar, ½ cupful of molasses, ½ cupful of sour milk, 1½ cupfuls of flour, 1 tablespoonful of butter, 1 teaspoonful of soda, ½ teaspoonful each of cinnamon and ginger, 1 egg.

Method.—Cream sugar and butter; dissolve soda in the molasses and milk; mix well; add sugar and spices, beaten egg and flour; mix well; bake in buttered pan in moderate oven about one-half hour.

MARGUERITES

Butter long branch crackers; beat white of egg stiff; add 1 tablespoonful of powdered sugar; spread on crackers; place blanched English walnuts on top of each other in half or chopped fine; place in oven until light brown; 1 egg (white) will cover 8 or more crackers. Very nice to serve for lunch.

ORANGE MINT CUPS

Cut sour orange in half; remove pulp; add 1 tablespoonful of powdered sugar, ½ teaspoonful of finely chopped mint, 1 teaspoonful each of lemon and cherry juice; chill; return to orange basket. Serve, garnished with mint.

FRUIT SHORTCAKES

Ingredients: 1 cupful of flour, 1 teaspoonful of baking powder, 1 teaspoonful of sugar, ¼ teaspoonful of salt,

1 tablespoonful of butter, ½ cupful of milk, 1 egg, 1 tablespoonful of powdered sugar.

Method.—Sift flour, baking powder, and salt together; cream butter and sugar; add beaten yelk; mix well; add milk and flour; beat thoroughly; roll ½ inch thick; cut in squares; butter well; place one on the top of the other; bake in moderate oven about fifteen minutes. When baked, separate and butter; cover with stiff beaten white and sliced orange; sprinkle with sugar; place squares together. Serve either hot or cold. Whipped cream may be used in place of white of egg. Any fruit desired may be used.

COOKERY ADJUNCTS

Crumbs are used for many purposes in the kitchen. Stale pieces of bread may be thoroughly dried in a cool oven and then brought to a golden brown, being careful not to scorch. All dark or burnt pieces should be discarded before rolling. If a food chopper is available, they may be passed through that. These will keep for some time in air-tight jars. Crusts and any scraps of clean bread may be saved and utilized in this way to improve the cookery of chops, fish, croquettes, and for various other purposes. Fresh crumbs are needed for dressing for meat foods, and for this purpose bread a couple of days old is best. The crusts should be removed before crumbing.

Browned flour is a term given to ordinary flour which has been spread thinly on a baking plate and slightly browned in a cool oven. Scorching or overbrowning must be guarded against. A scorched flour will render bitter any food in which it is used. Browned flour has a dark cream tint, and is used for thickening brown gravies, soups, and sauces.

Caramel is made by melting sugar over a slow fire and allowing it to simmer till it is a dark brown. Water is then added to it, and the liquid is used for coloring custards, sauces, gravies, soups, etc. A pound of sugar may

be diluted with a pint of water. The fluid will not ferment and will keep indefinitely.

Paper is also used for many purposes in the kitchen, and a supply of some kind should be on hand. "Kitchen" paper may be purchased for a trifle. Grease-proof paper costs more. Any clean paper, free from printing, may be utilized in various ways in the kitchen. Newspapers should never be used around food.

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SECTION VIII

SIX HUNDRED QUESTIONS FOR SELF-EXAMINATION AND REVIEW

CHAPTER LVI

QUESTIONS ON ANATOMY AND PHYSIOLOGY

1. DEFINE anatomy and physiology.

2. What do you understand by the term "organ" as applied to the human body?

3. What is the thorax and what are the principal organs contained in it?

4. How is the thorax separated from the abdomen?

5. What organs are contained in the abdominal cavity?

6. Explain what is meant by mucous membrane, the cell, the skin, tissues.

7. Name the chief systems into which the body may be divided.

8. Into what two main classes may tissues be divided?

9. What are the uses of osseous, connective, muscular, and cartilaginous tissues?

10. Why is nerve-tissue considered of great importance in the body?

11. How is the osseous system bound together?

12. What is the function of the respiratory system?

13. Give the two main divisions of the nervous system, and tell of what each consists.

14. What do you consider the chief functions of the nervous system?

15. Give a short description of the digestive system.

16. What is the function of the excretory system, and what organs are concerned in it?

17. Write a short description of the human skeleton.

18. Describe the spinal column.

19. What and how many bones form the framework of the chest?

20. Define clavicle, scapula.

21. Name the bones of the arm, including the wrist.

22. What are the phalanges, and where are they found?

23. Name the bones of the pelvis.

24. Explain the terms "acetabulum," "symphysis pubis."

25. Define femur, trochanters, tibia, fibula, patella.

26. Where are the tarsal and metatarsal bones found?

27. Give a short description of the human skull.

28. What are the uses of lime and gelatin in bone?

29. What is the periosteum, the synovial membrane, and show the importance of each?

30. Into what four main classes may bones be divided?

31. Give, from your study of the skeleton, an example of each class.

32. Define foramen, process, tuberosity, crest.

33. What are muscles? Divide them into two main classes.

34. Differentiate between voluntary and involuntary muscles, giving examples of each.

35. Define flexors, extensors, tendons, aponeurosis, fascia.

36. How is the erect position of the body maintained?

37. Where are the pectoral muscles located?

38. Locate the intercostal muscles, the diaphragm, the tendo Achillis.

39. Mention the abdominal muscles and state their chief functions.

40. Give an example of a hollow muscle.

41. Explain the terms "ligament," "capsule," and "articulation" in the body.

42. Give examples of movable and immovable joints.

43. What is a gliding joint? Give an example.

44. Describe a ball-and-socket joint, giving illustrations. What is a pivot joint?

45. Name two hinge-joints, and show how they differ from other joints.

46. What are the uses of cartilage in joints?

47. Explain the difference between mucous and serous membranes, and tell where each are found.

48. Name the organs of the abdomen?

49. What organs are contained in the pelvis?

50. What and where is the esophagus?

51. Write a short description of the stomach.

52. What functions are performed by the gastric fluid?

53. What are the chief constituents of the gastric fluid?

54. What is the length of the intestinal canal in the adult?

55. Name the divisions of the small and large intestines.

56. Locate the vermiform appendix.

57. What are Peyer's patches, peristalsis?

58. Describe the liver, giving average weight, location, and general structure.

59. Tell what you know of the functions performed by the liver.

60. What are the chief uses of bile?

61. What and where is the gall-bladder?

62. What are the functions of the pancreas and spleen, and where is each found?

63. What are the kidneys, and where are they located?

64. What work do the kidneys perform in the body?

65. Of what use are the ureters, and where are they found?

66. Locate the adrenals, and tell what you know of their uses.

67. Write short notes on the bladder, urethra, peritoneum, umbilicus.

68. Explain the term "abdominal viscera."

69. What do you understand by the terms "epigastric" and "hypogastric regions"?

70. Give a short description of the rectum and colon.

71. Explain what is meant by sigmoid flexure, anus, anal canal.

72. What is respiration?

73. What organs of the body constitute the respiratory system?

74. Describe the trachea.

75. Show how the mucous membrane which lines the trachea differs from that found in the mouth.

76. Write a short paper on the lungs.

77. What is the normal respiration and how would you determine the rate of respiration?

78. How may the power of chest expansion be increased or decreased?

79. What are the chief elements of the air?

80. Of what use is oxygen, nitrogen, carbonic acid?

81. Explain the terms "tidal air," "residual air."

82. What conditions tend to increase the amount of oxygen consumed in the body?

83. How is the exhalation of carbonic acid increased or decreased?

84. Define asphyxia.

85. How is the heat of the body produced?

86. What is the average normal temperature of the body?

87. How is heat thrown off by the body and the balance of heat controlled?

88. Show how the superficial arteries assist in heat loss?

89. What conditions may affect the body temperature in health?

90. Describe the blood. How would you distinguish venous from arterial blood?

91. What are the functions of the blood?

92. What parts of the body constitute the circulatory system?

93. Write a brief description of the heart.

94. Define the pulse, and what is the average pulse-rate in the adult?

95. Describe the arteries, veins, and capillaries, showing how they differ.

96. Name four arteries in which pulsation may be felt, giving the location.

97. What are the vena cavæ, aorta?

98. Describe the circulation of the blood, beginning with the right auricle.

99. Into what three main kingdoms may world materials be divided?

100. What causes waste of human tissue and how is it repaired?

101. Name the four chief chemical elements in the composition of the body.

102. What are the chief mineral substances found in the body?

103. How are these substances supplied to the body?

104. Explain the terms "secretion," "excretion."

105. How is the waste of the body eliminated?

106. Define digestion and give the different stages?

107. What parts of the body constitute the digestive apparatus?

108. How many teeth has an adult? What is saliva? Show how mastication influences digestion.

109. What part does saliva perform in the digestive process?

110. Give a short description of gastric digestion. What food elements are acted on by the gastric fluids?

111. What is chyme? What part of the digestive process is completed in the intestines?

112. Give a summary of the process of digestion.

113. Explain the terms "absorption," "assimilation," "metabolism."

114. By what means is absorption accomplished?

115. Tell what you know of the lymphatic system and its functions.

116. What are the chief functions of the skin?

117. Describe a healthy skin.

118. What are epithelial scales?

119. What glands are located in the skin and what work do they do?

120. Write a short paper on perspiration. What are the appendages of the skin?

121. Name and locate the organs which constitute the urinary system.

122. What is the average quantity of urine discharged from the body in twenty-four hours?

123. Describe normal urine.

124. What are urea and uric acid?

125. What conditions in health and disease influence the reaction of urine and the amount of urea and uric acid?

126. What variations in the color of urine may take place in health, and from what causes?

127. What changes in the urine would you expect fever to cause?

128. Name six drugs which may affect the color of urine, and tell some changes produced by each.

129. Explain the terms "specific gravity," "reaction," "micturition." What is the normal specific gravity of urine?

130. Which is the more serious, retention of urine or suppression, and why?

131. What conditions tend to produce scantiness of urine?

132. Give a brief description of the nervous system.

133. Define nerve, nerve-center. What are motor and sensory nerves?

134. What is the function of the cerebrum and where is it located?

135. Locate the cerebellum and the medulla oblongata, and tell the function of each.

136. Define pia mater, pons varolii.

137. Describe the spinal cord, stating its function in the body.

138. Explain the term "reflex action," giving an example.

139. What causes sensations? What do you understand by the term "general" or "common sensations"?

140. What causes produce sleep?

141. Name the organs of special sense.

142. Give a general description of the eye. Explain the terms "cornea," "retina," "iris," "accommodation."

143. How is the sense of touch produced?

144. What parts of the body assist in producing the sense of taste?

145. Where are the olfactory nerves? What function do they perform? What causes may weaken the olfactory nerves?

146. Write a short paper describing the ear. Where are the Eustachian tubes, and what is their function?

147. Where is the mastoid process?

148. Show why the axilla or armpit is an important structure in surgical conditions.

149. Into how many sections is the abdominal region divided for purposes of study, and name the divisions.

150. Write short descriptive notes on the inguinal region, the rectum, bladder, and vagina.

CHAPTER LVII

QUESTIONS ON CHEMISTRY

1. Define Chemistry.

2. Write a short paper outlining in a general way the field of chemistry and the part which it plays in our daily life.

3. What are elementary substances and compounds?

4. How many elementary substances have been discovered? Give a list of twenty which are commonly found in every-day life.

5. Define atoms; molecules. How many kinds of atoms are found in a molecule of sugar?

6. What do you understand by the term "chemical affinity"?

7. What is an atomic symbol?

8. Give the atomic symbols for magnesium, nitrogen,

oxygen, phosphate, copper, silver, iron, carbon, calcium, hydrogen, iodin, bromin.

9. How are atomic weights determined?

10. Give a list of the appliances and supplies needed for simple experiments in a chemical laboratory.

11. What is a formula in chemistry?

12. Define valences; chemical reaction.

13. What do you understand by the term "physical change"? Give two illustrations.

14. Define biology; biologic changes.

15. Explain the difference between physical and chemical changes.

16. What do you understand by the term "oxidation"? How does it take place?

17. Write a short paper on the chemistry of flame.

18. What is the difference between oxidation and combustion?

19. How is heat produced in the body? What becomes of the products resulting from heat production?

20. Write a short paper on ventilation, showing why it is necessary and what chemical changes are brought about in the air by opening a door or window admitting air from the outside.

21. Define humidity and explain how and why the degree of humidity varies in different times and places.

22. Mention four important elements found in all living matter.

23. What elements are found when water is analyzed?

24. Mention some of the chief uses of nitrogen. Tell where it is found.

25. What are the chief elements in kerosene, gasoline, and natural gas?

26. Write short notes on carbon, chlorin, bromin.

27. Mention two important compounds containing sulphur.

28. Mention briefly some of the important commodities containing sodium, and tell where it is found.

29. What is potassium? Where is it found? Why is it an important element in daily life?

30. What are the chief uses of calcium? Write the symbols for calcium carbonate.

31. Where does phosphorus come from? In what structures of the body is it chiefly found?

32. Why is phosphorus valuable in industrial life?

33. Mention some of the destructive effects which may accrue to workers in the phosphorus industry.

34. What are the chief uses of copper and silver as remedial agents? What effect is produced by using salt solution after an application of silver nitrate?

35. What part does iron play in the human system?

36. Give the important uses of mercury.

37. Write brief descriptive notes on zinc, lead, boron, silicon, bismuth, caoutchouc, wax.

38. Where are fats and oils obtained?

39. Explain what is meant by an organic compound. Give one of the distinguishing peculiarities of organic elements and compounds.

40. What is a carbon compound? Give illustrations of carbon compounds in common use.

41. Explain the terms "solution," "solute," and "solvent."

42. How is a saturated solution obtained?

43. Define deliquescence; effervescence. Give illustrations of drugs in common use which exhibit these properties.

44. Write a brief descriptive note on acids.

45. What part is played by acids in the human body? How is the presence of an acid in a substance commonly determined?

46. What is litmus, and what are its uses in chemistry?

47. What acids would you expect to find in the following substances—vinegar, grape-fruit, rhubarb, apples, grapes?

48. How is lactic acid produced?

49. Explain the terms "bases" and "salts" in chemistry.

50. Mention two chemical terms which are frequently used interchangeably with bases.

51. What is the most important characteristic of bases? How are they formed?

52. What is an alkali? Give some common illustrations of alkalies in daily use.

53. What is the effect of alkalies on acids?

54. Explain in a general way the process by which salts are produced.

55. Mention some of the important uses of potassium chlorid and ammonium chlorid.

56. What part is performed by salts in the nutrition of the body?

57. Explain what is meant by incompatibility in chemistry.

58. Make a list of the chemical constituents of the human body, giving the five most important elements first on the list.

59. How are these substances taken into the body? How thrown off from the body?

60. Define metabolism. Mention three diseases which result from disturbance in the metabolism of the body.

61. Mention three elements necessary in repairing the waste of the body.

62. What are the chief compounds required for the production of heat and energy in the body? Give a list of six articles of food in common use which contain these elements.

63. How would you prove that carbon is oxidized in the body?

64. What is a calorie? How are the caloric needs of the body determined?

65. Show why the caloric needs of a child differ from that of an adult.

66. What portions of the body are concerned in the production of digestive fluids?

67. Write a short paper on enzymes, telling how produced, their function in the body, and conditions under which they work best. How may they be destroyed?

68. What is saliva? Describe its composition. What is its use?

69. What glands are concerned in the secretion of saliva? Where are the openings of the ducts of these glands?

70. Mention any circumstance which tends to retard or increase the secretion of saliva.

71. What is ptyalin? How would you illustrate the action of ptyalin on certain food substances?

72. What is gastric juice? Where and how is it formed?

73. Mention the two most important enzymes contained in the gastric fluid.

74. What is glucose? Why is it sometimes given in solution intravenously?

75. What organ is concerned in the secretion of the pancreatic fluid?

76. Describe the action of the pancreatic fluid on various kinds of food.

77. What is bile? Where is it prepared? What are its uses in the digestive process?

78. What changes does the food undergo in the large intestine?

79. Describe the action of the gastric fluid, the pancreatic fluid, and the bile on fatty tissue.

80. Mention an important acid constituent contained in the gastric juice.

81. What effect would excessive secretion of this acid have on digestion?

82. What are the important points to be determined by an examination of stomach contents? Mention two chemicals used in making such examinations.

83. If the presence of undigested fat were found in a stool, what organ would you suspect as being the cause?

84. Give the chemical constituents of urine. Describe two chemical tests used in examining urine.

85. Explain the term "salt-balance."

86. Describe in a general way the effects produced by heat when applied to meat, coffee, bread dough.

87. What changes must starch undergo before it can be utilized in the human system?

88. State the chemical constituents of baking powder, and their effect when combined in food substances.

89. What are yeasts? How are they produced?

90. Describe some of the chemical reactions which take place in bread making.

91. What chemical changes are produced in bread by toasting it?

92. Mention three important alkalies commonly found in the household and their general uses.

93. In what common articles of food are the following acids found—acetic, malic, tartaric, lactic?

94. Where is oxalic acid obtained, and what are its chief uses? What care should be observed in using it, and why?

95. What are molds and what conditions are necessary to their growth?

96. What effect would you expect bichlorid of mercury to have on steel?

97. What is the general effect of chlorid of lime on cotton; on metals?

98. Mention three chemical compounds commonly used as solvents of grease.

99. What general effects are produced by the use of strong alkalies on paint and varnish? Give reasons.

100. How is soap made? Why is soap less effective when used in hard water?

CHAPTER LVIII

QUESTIONS ON HYGIENE

1. What do you understand by the terms "hygiene," "health," "sanitary"?

2. In investigating into the general conditions of any individual as relates to hygiene, what points would you consider?

3. What would you regard as requirements to health?

4. Show how germs are necessary to life and health.

5. What are pathogenic germs and how are they spread?

6. What do you regard as the most immediate essential to life, and of what does it consist?

7. How is air contaminated? How purified?

8. In providing for purity of air in any room, what points should be considered?

9. Show why ventilation of a room is necessary to health.

10. How is the blood purified?

11. What qualities would you regard as essential to good drinking water?

12. How may water become contaminated? How purified?

13. What changes are produced in water by boiling? How would you make boiled water palatable for drinking? How long should water be boiled to render it safe for drinking purposes?

14. Write a short paper on domestic filters, telling how they should be managed, giving reasons.

15. Give four diseases that may be communicated by impure water or ice.

16. Show how overeating may cause disease. What diseases are liable to be produced by deficiency in diet?

17. Give three common methods of adulteration of milk.

18. What do you understand by the term "ptomain poisoning"? Show how it may be caused by meats or fish.

19. Explain how raw vegetables may become infected with disease germs.

20. What would you consider as desirable and undesirable points in the location of a home or hospital?

21. What would you regard as dirt from a sanitary standpoint?

22. Show how flies and insects may become agents in spreading disease.

23. What are the common constituents of dust?

24. Explain why dust in a hospital ward should always be regarded as dangerous.

25. What substances would you consider dangerous as sources of infection in a medical ward; what in a surgical ward?

26. Show how a nurse may become a carrier of infection from one patient to another.

27. What general measures would you use to keep a hospital bathroom and service utensils in a sanitary condition?

28. How would you render infected floors, carpets, and rugs sanitary?

29. Give one method that is recommended for destroying insects.

30. Write a short paper on the hygiene of the digestive system.

31. Mention some important injurious effects that may result from neglect of teeth.

32. Explain why regular and frequent cleansing of the skin is essential to health.

33. What general effects are produced on health by a cold bath?

34. Give reasons why mouth-breathing is injurious.

35. What general measures would you recommend for the prevention of colds? What conditions predispose to this affection?

36. How does compression of the chest affect the health injuriously?

37. Write a paper outlining the general care a nurse should give her hands.

38. Give three general rules which a nurse should observe in the care of her feet.

39. What measures would you recommend for preserving the health of the eye?

40. Name three common practices which you would consider injurious to the eye.

41. In recommending a hygienic outfit of clothing for a woman what points would you consider?

42. Describe what you would regard as the correct position for the body to assume in standing.

43. What general precautions would you recommend to be observed when overheated?

44. Give two reasons why nurses should refrain from discussing their patients or their general work when off duty.

45. Show why a certain amount of exercise in the open air and sunshine is important.

46. Give four rules affecting the health, which you would recommend that nurses on night duty especially observe.

47. Write a letter of advice to a girl of sixteen who is leaving home, describing how she should care for her health.

48. Outline the general routine of living you would think important to observe in the care of a child of three years.

49. State the conditions you would try to secure for yourself or your patients during sleeping hours.

50. What degree of temperature would you regard as desirable for a sleeping room for a healthy person? What in a sick room?

CHAPTER LIX

QUESTIONS ON BACTERIOLOGY

1. Write short notes on the contributions of Pasteur, Lister, and Koch to bacteriology.

2. What do you understand by the terms "bacteria" and "bacteriology"? What conditions are necessary for the growth of bacteria?

3. Explain the terms "spore," "fission," "saprophytes," "parasites."

4. To which of the great world kingdoms do bacteria belong?

5. What good work is done by germs? Show why they are necessary to existence.

6. Classify bacteria according to shape.

7. How may germs be cultivated outside the body?

8. What are bacilli? Name two diseases produced by bacilli.

9. Where are germs found?

10. Write a short paper, telling in your own language how you would explain the germ theory of disease.

11. Define the terms "specific," "infectious."

12. Show why the term "communicable" is more accurate than "infectious" or "contagious" in speaking of germ diseases.

13. By what channels do germs enter the body?

14. How is infectious matter cast off by the body?

15. Name four diseases that may be acquired by contact.

16. How do the germs of the following diseases get into the system: Measles, small-pox, influenza, typhoid fever, septicemia, abscess, gonorrhea, erysipelas?

17. In what discharges are the germs of typhoid fever found?

18. Show how flies may become carriers of disease.

19. What general measures should a nurse use to avoid contracting typhoid fever while nursing a patient afflicted with it?

20. What discharges from the body would you disinfect in caring for a case of diphtheria?

21. How is tetanus contracted?

22. What organs or structures of the body are liable to be attacked by the tuberculosis germ?

23. Write a short paper on methods of prevention of tuberculosis.

24. How is malaria communicated from one person to another?

25. What discharges would you disinfect in caring for patients afflicted with pneumonia, erysipelas, cerebrospinal meningitis?

26. What measures would you use in caring for a case of small-pox to prevent the spread of the disease?

27. Explain the phrases, "incubation period," "immunity."

28. Show how natural immunity differs from acquired or artificial immunity.

29. Name four germs frequently encountered in sur-

gery, giving illustrations of some of the results they produce in the body.

30. Where are pus germs commonly found on a healthy body?

31. Show why surgical dressings should be protected from dust.

32. Give three ways by which bacteria may be destroyed. Explain how an article may have been sterilized and yet not be sterile.

33. Write a short paper giving the elementary facts you have learned about asepsis.

34. What is the difference between disinfection and sterilization?

35. Define antiseptics, germicides, deodorants. Explain the difference between asepsis and antisepsis.

36. How is sterilization usually accomplished?

37. What is the difference between ordinary cleanliness and surgical cleanliness?

38. How would you sterilize surgical instruments, and how many minutes would you consider the process should take?

39. Why is soda carbonate or bicarbonate sometimes added to the water used for sterilizing instruments?

40. What are the advantages and disadvantages of baking as a means of sterilization?

41. How long should surgical dressings and materials be exposed to live steam to render them aseptic?

42. Name seven articles which you would not sterilize or disinfect by steam, giving reasons.

43. What care would you use in packing a sterilizer for steam sterilization, and why?

44. Explain what is meant by the term "intermittent sterilization." Why is intermittent sterilization sometimes necessary? Show why it is rarely necessary in ordinary surgical work.

45. In what diseases would you expect to encounter spore-bearing bacteria?

46. Name seven points that should be considered in choosing a disinfectant.

47. Write short notes on each of the seven points, showing when they should be considered.

48. Name three substances which should not be disinfected with bichlorid of mercury. What general value would you place on carbolic acid as a disinfectant, and what precautions would you exercise in its use?

49. How may the air of a room be disinfected? What general precautions would you use in employing a gaseous disinfectant? Show why these precautions are necessary.

50. What value would you place on cleanliness, dryness, and sunshine in the prevention of disease? What effect do these natural agents have on germ life?

CHAPTER LX

QUESTIONS ON THERAPEUTICS AND MATERIA MEDICA

1. Define therapeutics.

2. Classify the causes of diseases.

3. Show how the term "action of remedy" is inaccurate.

4. Explain what is meant by self repair.

5. Give five common principles of treatment.

6. What are natural remedies, and give reasons why these should be used as far as possible?

7. Explain the difference between functional and organic diseases.

8. Name three common remedies derived from each of the three great kingdoms—animal, vegetable, and mineral.

9. What are prophylactic remedies?

10. Give three remedial agents which may be classed as imponderable remedies.

11. Define surgery, massage, materia medica, hydrotherapy.

12. Explain the difference between pharmacy and pharmacology. What is toxicology?

13. Define chemistry, pharmacopeia, dispensatory.

14. What is the difference between official and unofficial drugs?

15. Write the tables for apothecaries' weights and measures, and give approximate measures.

16. What is the difference between the minim and the drop?

17. Explain the difference between alkaloids and alkalies.

18. What are salts, acids? Name three vegetable acids.

19. Define cataplasma, cerates, chart.

20. Show how decoctions differ from infusions.

21. Explain what you mean by elixirs, extracts, emulsions, glycerites, mixtures.

22. What is the difference between fluidextracts and tinctures?

23. What are suppositories, and how may they be given?

24. What is meant by a saturated solution?

25. Write the symbols for dram and ounce and the abbreviations for pint, minim, grains, and drops.

26. What abbreviations would you use for: As you please; before food; twice a day; cubic centimeter; an eye-wash; let there be made; an hour; a pill; as occasion arises; through; let it be directed?

27. Explain the difference between physiologic and therapeutic action.

28. Give an illustration showing the difference between the primary and secondary action of drugs.

29. What are stimulants and sedatives?

30. Through what main channels do remedies produce their effects on the body?

31. Show how surrounding conditions may sometimes defeat the action of a drug.

32. Why are some drugs given before meals and some after meals?

33. State briefly six conditions which may modify the action of drugs.

34. What is a placebo? Give illustrations.

35. Explain the terms "idiosyncrasy," "accumulation."

36. Name ten drugs which sometimes produce a rash. Give two drugs which may affect the hearing.

37. What do you understand by the term "the therapeutic limit"?

38. Give the average dose of dilute acids, fluidextracts, potent tinctures, solid extracts, spirits, infusions.

39. How would you calculate the size of dose for a child?

40. State seven ways in which medicines may be administered.

41. What advantages have the stomach and hypodermic route for giving medicines over other methods?

42. Show why drugs given in solution take effect more quickly.

43. What would you suggest as the best time to give Epsom salts, and why?

44. In the absence of definite orders as to time, what time would you give bitter tonics, and when would you give iron, arsenic, lithia, salol, soda?

45. What do you consider the best time to give pills, cough medicines, and general systemic remedies?

46. How would you give a fluid medicine to a baby; a pill to a child? What general rules would you observe in giving stimulants to children? What rules would you observe in giving effervescing powders?

47. How would you give bismuth, bromid of potassium, sulphonal, tincture of chlorid of iron?

48. What measures would you use to disguise the disagreeable taste of castor oil?

49. In giving fluid medicines what general rules would you follow as regards dilution? Show why it is a safe rule to shake all bottles of fluid medicine before measuring a dose.

50. Give six general precautions you would observe

in giving all medicines. What special precautions should be observed in giving hypnotics?

51. What general methods would you use in giving medicine to delirious, unconscious, and insane patients?

52. At what temperature and in what form should medicines be for administration by rectum? What effects would you expect alcohol and fats, mingled with substances for rectal administration, to have on the rectum?

53. What is the best position for the patient in giving medicine by rectum?

54. For what reasons are rectal suppositories usually employed, and how would you give one?

55. Why is the hypodermic method used? Tell how you would give a hypodermic injection. What care would you give a hypodermic syringe before and after using?

56. How would you prepare to give steam inhalation to a child who had bronchitis?

57. Describe the precautions which should be used in giving oxygen and the method of administration?

58. State how medicines should be dropped into the eye, and the general precautions to be used in giving nursing treatments to the eye.

59. Name three medicines commonly administered through the skin.

60. How would you apply a fly-blister?

61. What are the chief uses of the douche?

62. What conditions or substances other than drugs may affect normal peristalsis?

63. Give a list of foods which have a laxative effect.

64. Give reasons why castor oil is a valuable purgative.

65. Why is olive oil used? Give a list of four simple purgatives, telling what you know about each.

66. Name four medicines which produce watery stools, and tell how you would give each one.

67. What are intestinal astringents? Name three, and tell how they should be given.

68. How would you prepare and give a starch enema containing laudanum, and state the average dose of laudanum you think should be used.

69. What are emetics, and why are they used? Name four, and tell how they should be given.

70. For what purposes are diuretics given? Give four substances used as diuretics, and tell what you know about each.

71. What are diaphoretics? What simple measures would you use to produce diaphoresis?

72. How would you give a hot-air bath to a patient in bed?

73. What general precautions would you use in giving pilocarpin, and why?

74. Name four classes of stimulants, explaining the action each is expected to have.

75. Give four reasons why cardiac stimulants are given.

76. What general measures would you use to improve the condition of the heart in case of shock?

77. What are the general effects of salt solution on the system?

78. Show how tea and coffee exert a stimulating effect.

79. Write short notes on ammonia, strychnin, digitalis, nitroglycerin, and adrenalin chlorid, giving the dose of each you would think safe if you had to give it in emergency.

80. Tell what you know about alcohol as a heart stimulant.

81. How would you know whether alcohol was or was not having a good effect on the patient?

82. How much alcohol does whisky contain?

83. What proportions of alcohol and water should be used in making dilute alcohol?

84. Name two drugs sometimes prescribed as cardiac sedatives.

85. What is an average dose of tincture of aconite? Give the signs of overdosing.

86. What would you consider dangerous symptoms in using veratrum viride, and what would you do?

87. Define and classify nerve sedatives.

88. What simple measures could you use to relieve insomnia before resorting to drugs?

89. How does chloral hydrate act, and how would you give it? What bad effects sometimes follow its use?

90. What is an average dose of hyoscin hydrobromate?

91. Write short notes on sulphonal and trional, and tell how you would give them?

92. State the effects you would expect paraldehyd to produce, and the average adult dose.

93. How do bromids act, and what bad effects do they sometimes produce?

94. Give the general effects of opium and four preparations of the drug?

95. Why is morphin often combined with atropin, and what is the average adult dose of each?

96. How does codein differ from morphin in its general effects?

97. How much opium does an ounce of laudanum contain. What would you consider a safe and a fatal dose of laudanum for a two-year-old child. What is the difference between a minim and a drop of laudanum?

98. Compare laudanum and paregoric as to strength and average adult dose.

99. Give the signs of opium-poisoning and the common antidotes used.

100. For what purposes are salol and sodium salicylate used?

101. What good and ill effects would you expect acetanilid to produce?

102. What is an average dose, and what are the general uses of phenacetin?

103. Name three drugs, besides opium, that are sometimes used for the relief of pain.

104. What are anesthetics and for what purposes are they used?

105. Why is ether usually preferred to chloroform?

106. How is cocain used, and how should it be prepared for hypodermic injection?

107. What common substances, apart from drugs, may be used as local anesthetics?

108. Define tonics, and name three drugs used as general tonics.

109. What would you include under the term "natural tonics"?

110. Show how attractive food acts as a tonic.

111. How may appetite be destroyed?

112. Write a short paper on pepsin.

113. What is an average dose of dilute hydrochloric acid?

114. What food elements are acted on by pancreatin?

115. On what substances does diastase act as a digestive agent?

116. For what purpose is iron given?

117. What ill effects would you expect from large doses of iron?

118. How would you disguise a dose of cod-liver oil?

119. What effect does cod-liver oil produce on the body? What time in relation to meals would you give it?

120. Name three bitter tonics.

121. Tell what you know about quinin.

122. Define antiseptics and germicides.

123. Show how ice exerts an antiseptic action.

124. What effect does salt or sugar have on vegetable matter?

125. How would you make normal salt solution, and for what purposes is it chiefly used?

126. What strength of solution of boracic acid is sufficient to arrest the growth of bacteria? How would you make a saturated solution?

127. What is peroxid of hydrogen, and for what purposes is it used?

128. How much carbolic acid would you use to make a pint of a 3 per cent. solution? Name two antidotes for carbolic acid.

129. Write a short paper on corrosive sublimate, and include what you would consider the important points which a nurse should know about it?

130. What strength of solution of lysol would you employ for hand disinfection, and what effects would you expect a too strong solution to produce on the skin?

131. In using formaldehyd for fumigation what amount would you use, and what general precautions should be taken in preparing a room for such fumigation?

132. How would you use formaldehyd in combination with permanganate of potassium for fumigation? How without it? What rule would you observe in computing the quantity of the drug needed for disinfection?

133. What advantages and disadvantages is sulphur said to have as a disinfecting agent, and how would you use it?

134. On what substances is milk of lime used as a disinfectant, and how would you use it?

135. How would you calculate the amount of salt needed to make a quart of a 5 per cent. solution?

136. What are the symptoms of salivation? Name two drugs that sometimes cause it.

137. What general effects are produced by iodid of potassium? How would you give it?

138. What is antitoxin?

139. For what purposes is ergot chiefly used?

140. How would you make flaxseed tea?

141. What are the uses of mustard?

142. State three purposes for which turpentine is used.

143. Write short notes on capsicum; hops.

144. Of what value is camphor as a remedy?

145. How would you make lime-water?

146. Classify poisons, and tell how the different classes act.

147. Tell what you would do in a case of poisoning by carbolic acid.

148. How would you proceed in a case of laudanum-poisoning?

149. What emetics would you use in a case of corrosive sublimate poisoning?

150. What symptoms would lead you to suspect poisoning by strychnin, and what would you do in such a case?

CHAPTER LXI

QUESTIONS ON DIETETICS AND INVALID COOKERY

1. WHAT processes are concerned in the nutrition of the body?

2. Define foods. What constitutes a perfect food?

3. What are the uses of water in the body?

4. Name the most important food compounds.

5. What functions do nitrogenous foods perform in the body, and what are the uses of non-nitrogenous foods?

6. Classify foods according to their alimentary principles.

7. Name the principal nitrogenous food substances and tell where each is obtained.

8. What are carbohydrates?

9. Name two animal and two vegetable foods which contain fat.

10. What foods would you give a child who needed more mineral matter?

11. Name the chief tissue-building foods, and the chief heat- and force-producing foods.

12. What vegetables contain little or no starch?

13. Prepare a day's menu for a patient, excluding starchy foods as far as possible, while giving variety.

14. What do you consider the three most immediate necessities of life? Why is air classed as a food?

15. What becomes of excess of food that is eaten?

16. What useful function may be performed by the indigestible parts of vegetables?

18. Define the terms "protein," "albuminoids," "gelatinoids," "proteid," "extractives," "dextrin," "lactose."

19. Show how the nutritive value of food is not the same in different individuals.

20. What would you consider an ideal diet?

21. Show why a mixed diet is advisable.

22. What conditions should be considered in deciding as to the amount of food required?

23. What should the diet for an individual's first two years consist of?

24. Give a list of foods which should be excluded from the diet of a child of three years.

25. Prepare two day's menu for a three-year-old child, giving reasonable variety.

26. What general rules should be observed in feeding children?

27. Give some conditions which should influence the diet during active adult life?

28. What results would you expect from overeating?

29. In arranging a diet for the period of advanced age what changes would you make from the diet suitable for active adult life?

30. Why would you make these changes?

31. Name seven conditions which may influence the digestibility of food.

32. In the cooking of food, what objects are aimed at?

33. How would you boil a piece of beef if you wished to prepare the meat to be used as food?

34. Give a rule for making beef broth.

35. What parts of beef would you consider stewing best suited for?

36. Name two points which should be specially observed in roasting meat.

37. Describe the proper method of broiling a beefsteak.

38. Divide soups into four classes and explain the difference between them.

39. Show why thorough cooking of starchy foods is very important.

40. Give three reasons why milk is not a perfect food for adults.

41. Why is milk of special value as a food for invalids?

42. Compare the food value of milk, beef, and bread.

43. What causes milk to become sour? Show why extreme care should be used to keep milk clean.

44. Compare skimmed milk and buttermilk with whole milk as to food value.

45. What do you mean by the pasteurization of milk? Why is it practised?

46. Why is lime-water added to milk?

47. Give four methods of varying a milk-diet.

48. What measures would you use to prevent milk disagreeing with a patient who disliked it?

49. Give one method of predigesting milk.

50. What is junket and how would you make it?

51. How would you prepare albumen water, eggnog, omelet?

52. Prepare a day's menu of at least six meals for a patient with mild fever, excluding milk, but giving as much variety as permissible in a fluid diet.

53. Compare beef, mutton, pork, and chicken as to digestibility.

54. What are sweetbreads, and how would you prepare and serve them?

55. What parts of beef give first, second, and third quality of meat?

56. Show why liver and kidney are not suitable meats for invalids.

57. Of what use is gelatin as food?

58. Compare salmon with white fish as to digestibility.

59. Compare a quart of oysters and the same amount of milk as to cost and food value.

60. Write a bill of fare for the nurse's table, including eight articles of food. Show how these eight articles contain all the important food elements.

61. What cereals are chiefly used as human food?

62. Compare the three common varieties of bread as to food value.

63. What effect does toasting have on the digestibility of bread? Describe briefly a badly made piece of toast, and show why it should not be served to invalids.

64. What is macaroni, and what is its general worth as a food? Give one method which you would recommend for cooking it.

65. Write a short paper on breakfast foods.

66. Why is thorough cooking especially important in cereal foods and not in flesh foods?

67. Give a list of nutritive and of flavor vegetables.

68. Of what use is rice as food? What are legumes? Of what use are they as foods?

69. How would you cook potatoes for an invalid so as to have them most easily digested?

70. Show why green vegetables which contain very little nourishment are yet essential to health.

71. Of what use is sugar as food? What results are produced when an excess of sugar is taken?

72. In what kinds of diseases or patients are sugars forbidden or used very sparingly? What is saccharin?

73. What are the uses of fruits in the diet?

74. Give a list of fruits you would consider easily digested; also a list of those containing most nutriment.

75. Compare nuts with apples as to digestibility.

76. What are condiments, and what are their uses in the diet? Name the principal condiments.

77. Name the two common beverages which contain tannin. How is it extracted?

78. How does green tea differ from black tea? How should tea be made?

79. What good and bad effects are attributed to the use of tea?

80. Give a rule for making coffee for an invalid. What are the good and bad effects produced by coffee on the system? What are the active stimulating elements in tea and coffee?

81. How does cocoa compare with tea and coffee as to nutritive value? How would you prepare cocoa?

82. Show why fluid diet is preferred as a food in fevers.

83. Give the general principles which are considered in the diet in acute fevers.

84. Why should abundance of water be given to such patients?

85. How would you alter milk so as to increase its digestibility for fever patients?

86. What conditions would you consider essential to success in food serving?

87. How may a nurse promote the comfort of a weak convalescent patient while taking his food?

88. Give the general principles which would guide you in feeding helpless patients.

89. How would you prepare scrambled eggs and toast?

90. Give three methods of preparing toast; three sandwiches which you would consider wholesome for invalids.

91. Write two bills of fare each for breakfast for a hearty invalid in August, and in December.

92. Prepare potato purée, baked rice pudding, jelly from calves feet, and oyster stew.

93. What are croutons? How would you make and serve mutton broth to an invalid?

94. Outline two day's menu for a patient who was allowed solid foods, but no meat of any kind.

95. How would you prepare and serve mutton chops, scraped beef, beef juice?

96. Give two ways of preparing rice to be used as a vegetable.

97. Write the rules for preparing three desserts you would use in feeding a typhoid fever patient during convalescence.

98. Give two methods of preparing prunes.

99. Give a list of fruits you would recommend for their laxative effect.

100. Prepare and serve a cottage-cheese salad; a fruit salad.

APPENDIX

THE METRIC SYSTEM

WEIGHTS

1 milligram	=	0.001 gram
1 centigram	=	0.01 "
1 decigram	=	0.1 "
1 gram	=	1.0 "
1 decagram	=	10.0 grams
1 hectogram	=	100.0 "
1 kilogram	=	1000.0 "

LENGTHS

1 millimeter	=	0.001 meter
1 centimeter	=	0.01 "
1 decimeter	=	0.1 "
1 meter	=	1.0 "

CAPACITY

1 milliliter	=	0.001 liter
1 centiliter	=	0.01 "
1 deciliter	=	0.1 "
1 liter (l.)	=	1.0 "

APPROXIMATE EQUIVALENTS

1 cc.	=	15 minims
4 cc.	=	1 fluidram
30 cc.	=	1 fluidounce
1 gram	=	15½ grains
1 decigram	=	1½ "
1 centigram	=	$\frac{1}{6}$ grain
1 milligram	=	$\frac{1}{64}$ "
1 liter	=	1 quart
1 kilo	=	$2\frac{1}{5}$ pounds avoirdupois
1 cm.	=	$\frac{2}{5}$ inch

PHYSIOLOGIC SALT SOLUTION

Sodium chlorid	gr. 50
Potassium chlorid	gr. 3
Sodium sulphate Sodium carbonate	gr. 25
Sodium phosphate	gr. 2
Boiling water	gr. 1

HOUSEHOLD ANTIDOTES[1]

For bedbug poison For corrosive sublimate For blue vitriol For lead-water For saltpeter For sugar of lead For sulphate of zinc For red precipitate For vermilion	Give milk or white of eggs, large quantities.
For Fowler's solution For white precipitate For arsenic	Give prompt emetic of mustard and salt, tablespoonful of each; follow with sweet oil, butter, or milk.
For antimonial wine For tartar emetic	Drink warm water to encourage vomiting. If vomiting does not stop, give 1 grain of opium in the water.
For oil of vitriol For aqua fortis For bicarbonate of potash For muriatic acid For oxalic acid	Magnesia or soap, dissolved in water, every two minutes. For oxalic acid, give calcium carbonate or hydrate (lime-water, chalk, wall-plaster, in water).
For caustic soda For caustic potash For volatile alkali	Drink freely of water with vinegar or lemon juice in it.
For carbolic acid	Give flour and water, glutinous drinks, and a form of alcohol.
For chloral hydrate For chloroform	Pour cold water over the head and face, with artificial respiration; galvanic battery.
For carbonate of soda For copperas For cobalt	Prompt emetics; soap or mucilaginous drinks.
For laudanum For morphin For opium	Strong coffee, followed by ground mustard or grease in warm water to produce vomiting. Keep in motion.
For nitrate of silver For strychnin For tincture of nux vomica	Give common salt in water. Emetic of mustard or sulphate of zinc, aided by warm water.
For iodin and iodids	Prompt emetic; solution of starch; flour and water.

[1] Table of Household Antidotes quoted from *Pocket Cyclopedia of Medicine and Surgery*, Gould and Pyle.

TABLE OF BONES

Skull (cranium)	
Frontal	1
Occipital	1
Parietal	2
Temporal	2
Sphenoid	1
Ethmoid	1

Face	
Nasal	2
Malar	2
Inferior turbinated	2
Maxilla	2
Lacrimal	2
Palate	2
Vomer	1
Mandible	1

UPPER EXTREMITIES

Clavicle	2
Scapula	2
Humerus	2
Radius	2
Ulna	2
Metacarpal	10
Phalanges	28

Trunk (vertebræ)	
Cervical vertebræ	7
Dorsal vertebræ	12
Lumbar vertebræ	5
Sacral (5)	1
Coccygeal (4)	1

Trunk	
Ribs	24
Os hyoid	1
Sternum	1

Carpal	
Scaphoid	2
Semilunar	2
Cuneiform	2
Pisiform	2
Trapezium	2
Trapezoid	2
Os magnum	2
Unciform	2

LOWER EXTREMITIES

Os innominatum	2
Femur	2
Patella	2
Tibia	2
Fibula	2

Tarsal	
Os calcis	2
Astragalus	2
Cuboid	2
Navicular	2
Internal cuneiform	2
Middle cuneiform	2
External cuneiform	2
Metatarsal	10
Phalanges	28
Total	200

TEMPERATURE

The two methods of expressing degrees of heat and cold (Centigrade and Fahrenheit) are expressed by the symbols C. and F. respectively.

The freezing-point of water (32° F.) is the zero point of the Centigrade scale. The boiling-point of water (212° F.) is equal to 100° C.

To reduce Centigrade degrees to those of Fahrenheit, multiply by 9, divide by 5, and add 32.

To reduce Fahrenheit degrees to the Centigrade scale, subtract 32, multiply by 5, and divide by 9.

TABLES FOR COOKING

A speck makes one-quarter saltspoonful.
Four saltspoonfuls make one teaspoonful.
Two gills make one cupful.
One wineglassful makes one-half cupful.
Ten eggs, average size, make one pound.
One tablespoonful of butter makes one ounce.
One tablespoonful of granulated sugar makes one ounce.
One scant pint of granulated sugar makes one pound.
One pint of butter makes one pound.
One cupful of rice makes one-half pound.
One cupful of stale bread-crumbs makes two ounces.

A spoonful means that the material should lie as much above the edge of the spoon as the bowl sinks below it. A heaping teaspoonful means that the material should be twice as high above the edge of the spoon as the bowl sinks below it. A level teaspoonful should hold sixty drops of water. All dry materials are measured after sifting.

A spoonful of salt, pepper, soda, or spices, should be level.

One-half of a spoonful is measured by dividing through the middle lengthwise.

TIME FOR BROILING

Steak, 1 inch thick	4 to 6	minutes
Steak, 2 inches thick	8 to 15	"
Fish, small and thin	5 to 8	"
Fish, thick	15 to 25	"
Chicken	20 to 30	"

INDEX OF DRUGS

INDEX